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Yellow-headed Blackbird (Xanthocephalus xanthocephalus) in phragmites, photographed by W. H. Carrick at Delta, Manitoba, May 16, 1946.

COMMON SENSE IN COMMON NAMES

BY LUDLOW GRISCOM

THERE is now quite an extensive literature on the subject of vernacular names; the most recent, by Eisenmann and Poor (1946. *Wilson Bulletin,* 58:210–215), attempts to suggest some "principles" of vernacular nomenclature. I have read all these papers with much interest, and reflected on the subject for years. If I might sum up the approach of the various authors, their premises, implied or expressed, would appear to be as follows: 1) "common" names are of great use in popular bird study, and they must be invented if necessary; 2) unfortunately, many have proved to be too local, inappropriate, misleading, or otherwise absurd; 3) some "simple and logical principles" should be formulated, by which appropriate and associative names can be selected; 4) the A.O.U. Check-List Committee are earnestly begged to do so, and are politely taken to task for having done badly in inventing subspecific names in the past, and having let everything else slide; 5) we learn that appropriate and associative names should not: a) give a false impression of taxonomic relationship, b) employ geographic or political divisions, c) use names of persons, or d) use incorrect descriptive names like "Palm" Warbler.

It seems to me high time that amateur bird students should realize that there is another side to the picture. Not being a member of the Check-List Committee, I am free to say that they are neither a group of moss-back conservatives, nor are they uninterested pedants, living at ease in a rarefied atmosphere of technical names. Actually premises one and three are fallacious and the Committee probably know it !

1. Common or vernacular names are *not* necessary for the amateur naturalist, and it is a psychosis to think so. The only mistake earlier A.O.U. Committees made was to *start* inventing vernacular names. The poor men have been sunk ever since !

2. The growth of knowledge of natural history inevitably makes older vernacular names too local, incorrect, or absurd on one count or another. The same fate is in store for a certain proportion of those invented today for recently described or little-known birds.

3. No "simple and logical principles" for vernacular nomenclature can be formulated. There are far too many birds; their variations, relationships, and ranges are not simple or logical. Their habits and habitats change from season to season, from one section of the continent to another, from century to century. Which season, which habitat, which section of the country is to be the basis for the "appropriate or associative" name?

Discussion. The only real origin of common names in history is a matter of degree of interest and observation of native peoples. The English and Germans were pretty good, the Hawaiians were astonishingly observant, the ancient Greeks and Romans were atrocious, as are most Latin Americans. In English the words crow, finch, swallow, wren, etc. go back to prehistoric times, and only scholars might tell us what these words originally meant. Our forefathers applied some of these old names to American birds on fancied resemblances. Totally different American birds were given descriptive names, for example: hummingbird, sapsucker, and road-runner. Native names were adopted and anglicized for others: ani, caracara, jacana, chachalaca. Others were onomatopoeic: pewee, bobolink, whip-poor-will.

It was more than a century ago that ornithologists discovered that the variety of species was great, and more and more old English names became group or family names. Species names were invented here and there; Wilson and Audubon were by no means happy in some of their choices. But when all is said and done, most birds of the world have no vernacular names in any language, and the question arises, why should they? What is the matter with the technical or scientific names?

Amateur bird students' reactions to technical names are curious and inconsistent. They refuse to learn *Uria lomvia* (which means nothing), and are perfectly content with the "common" name Brunnich's Murre, which also means nothing ! Who can show that the latter is easier to remember than the former? A startling contrast in attitude is discovered the moment one turns to other branches of natural history. There are numerous students of beetles, butterflies, shells, ferns and wild flowers, shrubs and trees—the number of competent women in garden clubs alone puts the membership lists of the leading bird clubs to shame —and in these groups of living forms an enormous and staggering welter of species, genera, and families are known; yet no one has ever suggested that common or vernacular names for them should be invented out of whole cloth. There are nothing but the scientific or technical names, and in no time at all the interested amateurs rattle off these "Latin" names as readily as ornithologists do those of birds. Many of my readers will have some spiraea, cyclamen, Forsythia, crocus, scilla, Wistaria, or delphinium in their gardens, and know perfectly well what flowers these names represent. They are all technical generic names, freely used in default of a vernacular name. What of it that nobody now cares or knows who Wistar or Forsyth were?

There are just enough cases of the popular use of technical names of birds to prove my point. The critics of vernacular names have never objected to cotinga, trogon, or junco. They have never suggested dropping vireo, and reverting to the old vernacular name "greenlet." No Californian boggles over Phainopepla. Students on a holiday go to the Rio Grande Valley, hoping to add the Texas Pyrrhuloxia to their life list, their fun not in the least spoiled because

of its lack of a common name! Other vernacular names are minor corruptions of the technical name, like tanager and gallinule, possibly fulmar and pelican. Bird students freely talk nowadays about Accipiters and Buteos, they work over the difficult Empidonax flycatchers; they learn the difficult warblers in part by learning the characters for the Vermivoras and the Dendroicas, two recognizable genera completely lost in the numerous inappropriate "common" names. In recent decades other students have begun to travel in the tropics; they wish to identify birds in Mexico, Guatemala, and the Canal Zone belonging to families and genera utterly different from anything in the United States. But after the first spasm of regret that there were no "common" names, they got down to work and became perfectly at home in handling and using the technical names.

The welter of vernacular names in many languages, the absurdity or inappropriateness of many, and the great variety of species or types, led to the invention of the Linnaean system of technical nomenclature. The "simple or logical" system broke down, by sheer weight of numbers, the hopeless complexity of relationships and degrees of difference. A code of nomenclature had to be drawn up, and with a little study it was seen that the only hope for stabilization in the future was to invoke the principle of priority, the earliest name, and in certain cases to conserve a long used and well known name. The code *has* to be complex and difficult, special experts now sit on permanent commissions and arbitrate as many difficult cases per annum as possible. Many early names, absurd, barbaric, inappropriate, incorrect, or "Rabelaisian" had to be retained.

Exactly the same fate awaits those who would reform or invent vernacular names. There would first of all have to be a code of nomenclature, and the principles would not be simple or logical. It sounds fine to select "appropriate and associative" names, but the only people who think it can be done are those *who are aware of very few birds in a small fraction of their total ranges only*. The fact is that the great majority of birds *can't possibly have* an "appropriate and associative" name, and the better known they are the more obvious this becomes. It makes no difference whether these names are good English words or are based on Greek and Latin roots.

Illustration must be limited to a few examples only. All American authors agree that *the* Chickadee (*Parus atricapillus*) should be called the Black-capped Chickadee to distinguish it from the Brown-capped or Hudsonian Chickadee. This name is most inappropriate. Actually there are four species with black caps in the New World, and at least as many more in the Old. Moreover, there is a chance that our particular Chickadee may prove to be conspecific with one of them. Imagine the absurdity of calling one subspecies *the* Black-capped Chickadee, when every other subspecies is also black-capped. Moreover, there are several brown-capped chickadees, two species in North America. Finally

should "chickadee" be conserved? They are all *Parus*, the English name for which is "titmouse," and we are supposed to show relationships!

All agree that Blackburnian Warbler is a dreadful name; Hemlock or Orange-throated Warbler have been suggested. But it breeds in hemlock only in the southern parts of its breeding range, several other warblers nest in the same hemlock grove; it occurs in migration over an enormous area where there are no hemlocks; it winters in tropical rain forests in eastern Panama. Another "orange-throated" warbler occurs in Panama! I can see the active Canal Zone Bird Club of the future petitioning the Committee to invent a more appropriate name!

The points in the last paragraph may be expanded to the whole warbler family. I agree heartily with Messrs. Poor and Eisenmann that, ideally speaking, appropriate and associative names should *not* be open to criticism on the four grounds given in item 4 of the first paragraph. It works out as follows: Out must go Prairie, Palm, Worm-eating, Magnolia, Myrtle, Sycamore, Connecticut, Kentucky, Nashville, Cape May, Tennessee, Calaveras, Colima, Canada, Blackburnian, Audubon's, Wilson's, Swainson's, Bachman's, Virginia, Lucy's, Sennett's, Townsend's, Grace's, Kirtland's, Macgillivray's. Moreover, Chat and Redstart are names of Old World genera in other families; water-thrush is utterly misleading in family relationships, oven-bird is the name of a family in another suborder. The Blue-winged does not possess a blue feather, the Orange-crowned does not have an orange crown, the Cerulean is not cerulean, and the Black-throated Green is one of four closely related black-throated green species! No less than 40 out of 57 vernacular species names would have to go, plus 6 additional subspecies.

Even worse, none of them could be called warbler, a name properly belonging to the Old World Sylviidae. We have no sparrows, or flycatchers, and we must eliminate Robin, Blackbird, and Oriole. Murres are really Guillemots; the Pigeon Hawk can't catch pigeons and is a subspecies of the Merlin. The Duck Hawk is really one of three American subspecies of the Peregrine Falcon. The Marsh Hawk is a harrier, very distinct from *the* Marsh Harrier of Europe; actually it is a subspecies of *Circus cyaneus*, the Hen Harrier, a specific name which is absurd and must go also, as *Circus cyaneus* very rarely catches hens, and no more often than other species of harriers! Our buteos are really buzzards; the name, Sparrow Hawk, properly applies to a small accipiter; our Sparrow Hawk is a kestrel; our vultures are not vultures, an Old World group. And so I could go on and on. I estimate that 80 per cent of the current vernacular species names of North American birds would get thrown out, on the basis of the criticisms of Messrs. Poor, Eisenmann, Peterson, Pough, and others. Readers will please note that, on the same grounds, just about 80 per cent of the

technical or *scientific* names are objectionable also. Actually this sense of inadequacy or inaccuracy of both scientific and vernacular names is an excellent measure of a century's increase in knowledge of North American birds.

Let us now suppose that a Committee really does start work on a system of "vernacular nomenclature." Where do they start, and above all *where do they stop?* What "simple and logical" guiding principles will they use in deciding what proportion of the 80 per cent criticizable names will be thrown out or emended? They will discover that there are none; the rules of vernacular nomenclature will prove to be just as complicated and just as arbitrary as those for the technical names. The Committee will probably end by adopting the same principle of priority and conserving all well known names in general use a whole century.

If they junk all 80 per cent of the inappropriate names, they will have to invent several thousand "appropriate and associative" names. Mostly, none can be found for family, genus, species, and subspecies. What is an appropriate family name to replace the inaccurate "warbler," a generic name for chat, oven-bird, water-thrush, and redstart? A much discussed species without a good vernacular name is *Vermivora ruficapilla* Wilson, going back to 1811. The eastern subspecies bears the absurd name, Nashville Warbler, and the western race bears the equally absurd name, Calaveras Warbler. Actually, the technical name is also absurd and inaccurate. Translated it means "rufous-haired worm-eater." Now the members of the genus Vermivora don't eat worms any more than other warblers. The species also has very few rufous hairs. Virginia's and Lucy's Warblers are the two species of the genus which *are* rufous-capped, but they were not discovered until 50 years after Wilson shot his warbler at Nashville, Tennessee. Perhaps I am a pedant when I see no reason to reform vernacular names, any more than the technical. To those who have frequently argued that most amateurs can't translate Latin and Greek roots, I point out that the names, Nashville and Calaveras Warbler, are absurd, inaccurate, meaningless, and therefore no easier to memorize than *Vermivora ruficapilla,* actually the only species designation the poor little bird has at the moment.

Let's waive all this, and pass to the invention of the four necessary vernacular names. Surely it is more important to have the family name taxonomically correct than the specific name. The family name, "Wood Warbler," will scarcely do for chats, yellow-throats, prairie "warblers," water-thrushes, and other ground and thicket-inhabiting birds. The subspecific names for *Vermivora ruficapilla* are easy: "eastern" and "western," but eastern what? I feel I know this warbler very well, and not only its technical or specific characters, for I have had field experience with both subspecies on their breeding grounds, migration routes,

and winter ranges. For many years I have been quite unable to think of a "simple, appropriate or associative" name that would be valid in all sections of the country, or a descriptive adjective that would apply to this species of "warbler" only. There are too many warblers, and the diagnosis of this species cannot be boiled down to one or two English adjectives. All the vernacular names suggested are too local, only partially true, or not sufficiently restrictive.

If we had a Gallup poll, and a thousand bird students of proper geographic distribution sent in a name on a postcard, it would be very surprising if a hundred of them picked the same one. Meanwhile the A.O.U. Committee has agreed to provide a species name; whatever one they dig up, my guess is that they will be soundly denounced by a certain percentage of students.

I hope I have succeeded in showing to unprejudiced readers that all is not as easy as it sounds. Vernacular English nomenclature *must* be just as complicated as scientific nomenclature. Naturalists abandoned seven decades ago, as a result of bitter experience, all efforts to reform technical species and group names by throwing out inappropriate and inaccurate ones, because: 1) unanimous agreement could never be reached and 2) the apparently more appropriate name turned out to be inappropriate in another decade or two with increased knowledge.

Those who wish for a reform of vernacular names must be prepared to jump four tough hurdles: 1) Complete or partial reform; if the latter, what dividing line? 2) Either way, a code of nomenclature must be drawn up, it must be administered by a commission, and it will be a five or more years' job to reach general agreement on the improved vernacular names. 3) The improved new vernacular names will automatically *create a synonymy* of English names, as well as the already existing synonymy of technical names, a burden and a handicap to scientific work. Every text-book, guide, State, and local list of the present will be out of date. A new generation of amateur bird students, brought up on the new names, will have to have the names in Chapman's books, Forbush, Ridgway, and several hundred others, translated for them by "technical" experts. Perhaps Mr. Peterson's publishers will go to the expense of getting out a new edition of his guides, with the necessary synonymy of vernacular names. 4) The new names having been invented and officially published, what happens next? Are they *to be conserved,* or is every new A.O.U. Check-List Committee to be allowed to change some, the moment they think another name a real improvement? What is to prevent each Committee from expressing themselves by playing ducks and drakes (with special reference to *Tadorna* and *Casarca*) with the common names? What is to prevent a "reactionary" committee from reverting to the "good old" names, warbler, robin, oriole, and flycatcher?

A primary article of the code will, therefore, have to be an arbitrary rule that the new names in the new A.O.U. Check-List of 195—

will be conserved. Its protagonists had better make sure in advance that unanimous approval, consent and obedience have been obtained. In the meantime, I formally propose that the names in the 1931 A.O.U. Check-List be conserved.

The protagonists of reform in vernacular names must pass from destructive to constructive criticism. Their criticisms are perfectly valid; they have merely discovered for themselves what ornithologists have known for a century: vernacular names in every language, and scientific and technical names as well, are replete with absurdities, inaccuracies, and false taxonomic implications; there are not enough descriptive adjectives in any language to replace geographic names and names of persons, and there are too many birds with too complex degrees of relationship. In the sense that English words like crow, wren, and warbler are nouns, there simply are not enough bird nouns for the hundreds of families and major groups known today. So far, the best proof of this is the few suggestions thrown out, by way of illustration, of improved names in articles otherwise purely critical. Any competent ornithologist can find fault with any one of them *extempore,* as not satisfying the criteria for good vernacular names agreed to by the critics themselves !

I consequently respectfully offer the following suggestions to those friends of mine interested in the reform of vernacular names.

1. The failure of the A.O.U. Committee to act is because they believe, or know, that simple, logical, appropriate, associative, and taxonomically correct vernacular names cannot be invented for the families, genera, species, and subspecies of North American birds.

2. Those who think it can be done might at least produce such a revised list and secure agreement *throughout the country* among amateurs interested in vernacular names.

3. Reform should begin with the names of families and major groups, the names of species and subspecies should come last. To return to the Nashville Warbler, why get excited about "Nashville" and not about "Warbler"? At least the species passes through Tennessee every spring and fall, but it positively is not a warbler !

4. Coining names for subspecies is a waste of time. This is one thing the critics of vernacular names have indirectly proved. All of them agree that the main reason for discussion is because vernacular names are of so much use in the development of popular ornithology. But there is no such thing as popular study of the finely drawn subspecies of the day, so there is no need for vernacular names. The subspecies of the moment is dropped tomorrow, or it will become two subspecies, or a revision of the races of some species results in a completely different arrangement. The newly invented vernacular name disappears. Or to which one of the two new subspecies shall it apply? It

might prove inappropriate for both. A "western" junco was collected in Massachusetts in 1874. It has already appeared in literature under *four* different vernacular names. It will undoubtedly appear under a fifth as a result of Dr. Miller's recent monograph. Those who invented the first four vernacular names wasted their time. Why should there be any better luck with the fifth?

5. In those few cases where subspecies are distinguishable in life and are, therefore, subjects for popular study and observation, well known vernacular names are already available and should be used. This in itself would be an expert guide to beginners, as to which subspecies could be identified in life.

MUSEUM OF COMPARATIVE ZOOLOGY, CAMBRIDGE 38, MASSACHUSETTS

A STUDY OF THE GYRFALCONS WITH PARTICULAR REFERENCE TO NORTH AMERICA [1]

BY W. E. CLYDE TODD AND HERBERT FRIEDMANN

THIS paper is in essence a combination of two papers written independently by the two authors a dozen years ago which they refrained from publishing, each in deference to the other. The results, which were from the start in close agreement, have here been brought together as a contribution to our understanding of one of the most puzzling of North American birds.

The gyrfalcons have probably given more trouble to taxonomists than any other group of arctic birds. The confusion centers around the question of the number of recognizable forms and the name properly applicable to each. Some writers have indeed declined to commit themselves one way or the other. To review the work of all the students who have attempted to deal with this subject would require much space and would not be particularly profitable. We shall confine our comments, therefore, mainly to a discussion of the remarks of more recent writers insofar as their conclusions seem to have a bearing on our own studies of this group. With an incomparable series of 190 specimens brought together by Friedmann for use in his continuation of Ridgway's "Birds of North and Middle America," we have been able to examine and compare ample material from various parts of Arctic America, as well as a smaller amount from the Old World.

L. Stejneger (1885:184–188) presented his views on the gyrfalcon question after a study of the series (then 75 skins) in the U. S. National Museum and an examination of the literature. He decided that there were two distinct species, the white and the brown, the latter divisible into three geographic races, all of which were represented in Arctic America. His arrangement was forthwith adopted by the American Ornithologists' Union, and so appears in the first three editions of the A.O.U. Check-List. The fourth (1931) edition, however, presents an arrangement entirely different, although with reservations and critical comments which, in a measure, seem to support Stejneger's views.

The main stumbling block to an understanding of the gyrfalcons is the occurrence in the same geographical area of both light and dark birds. So different are these two types at first glance that the impression is that two perfectly distinct species are concerned—just as Stejne-

[1] Published by permission of the Secretary of the Smithsonian Institution. The following institutions kindly lent specimens to us for study to supplement the combined series of the Carnegie Museum and the U. S. National Museum, and to their officials we hereby express our appreciation and thanks: American Museum of Natural History, Academy of Natural Sciences of Philadelphia, Chicago Natural History Museum, Museum of Comparative Zoology, University of Michigan Museum of Zoology, National Museum of Canada, and the Royal Ontario Museum of Zoology.

ger claimed. Moreover, the variation exhibited within both types—to whatever cause attributed—is striking, and comparable to that shown by certain species of *Buteo*. The real significance of these variations is the key to the whole situation, but many authors have been forced by lack of material to content themselves with simply describing them.

The gyrfalcon of Greenland has been the subject of sundry dissertations by various authors, and probably more specimens are now available from that country than from any other part of the Arctic. It thus affords a convenient starting-point. For the purposes of the present study we have examined 70 Greenland specimens—mostly from the west coast, from Etah on the north to Frederikshaab on the south. Among these are a number of the important key specimens discussed and figured by Walter Koelz (1929). Koelz, like Hartert (1913:1064) states that the gyrfalcons of Greenland are of three types; unlike Hartert he tries to distinguish these three types as subspecies. He is not successful, however, in assigning a separate range to each of the three forms and even suggests that this is not necessary for their recognition as subspecies! He restricts the name *candicans* to the white birds from farthest north and from the east coast but refers to a "dark phase" of *candicans* which we find indistinguishable from individuals he assigns to other races.

There is, of course, a possibility that a large enough series of *breeding specimens* might show geographical differences between the birds of north Greenland and those of south Greenland, as Koelz claims. Not enough is known about the migrations of these birds to justify a positive statement on this point. However, the table of distribution he gives (page 215) is certainly suggestive. If the several types are segregated during the breeding season it is astonishing how soon they become intermingled. Examination of our own series seems to bear out the impression that we are dealing here with one extremely variable form rather than with several races. Every character upon which reliance might be placed for the discrimination of geographic races breaks down when tested by this series. In general, there are two phases, a light and a dark. Some of the light birds are pure white below, and from this condition there is a gradual transition to birds that are heavily spotted below with dusky or brown (the spots being drop- or tear-shaped, as a rule). The upper parts, including wings and tail, are even more variable than the under parts in light birds, ranging from heavy barring above to dark markings that are clearly lengthwise; in a few specimens the upper parts are nearly immaculate. The head is pure white in some light individuals, conspicuously streaked in others. The tail varies from pure white to heavily barred. The point to be emphasized is that none of these variations can be shown to be correlated with others or with the locality of capture.

The dark birds, considered as a group, are equally variable in color characters. In general size and proportions they are like the light birds. Koelz has shown (page 209) that some young birds taken from the nest are as white as any adult. This point is important, because it definitely disposes of the idea that the dark birds might be the young of the light ones. In other words, light birds are light from the first, and dark birds dark from the first. (*Cf.* in this connection Hancock, 1854, and Newton, 1862:45.) Koelz's statement that light birds are confined to north Greenland directly contradicts Hartert (1915:184), who says: "It is, however, not true that the darker birds alone breed in Southern Greenland, where white ones nest also, nor that the dark form is restricted to the southern parts of Greenland, because it ranges as far north as any Falcons have been shot, and that during the breeding season. There is therefore no question of there being two subspecies, but the light and dark birds from Greenland can only be either two species or one and the same." To us, Hartert's argument appears conclusive, and it is borne out by the series we have examined. But if any further evidence were needed, it is supplied by the statement of R. Luff Meredith (in a letter to Friedmann) that two young (from a brood of three) were taken from a nest in Tissaluk Fjord, north of Ivigtut, and raised by hand. One of these is light, the other dark. The parents were "rather dark." The case suggests the need of further scientific field observations.

Coming now to the Labrador bird, of which we have examined 40 specimens—an incomparable series—we find a similar situation, but with this difference, that dark birds greatly outnumber the light ones. Todd's field party secured 21 specimens at and near Fort Chimo in September 1917. All but three of these were dark birds. As a special effort was made to secure light birds, the actual proportion was probably smaller still. The concentration of these birds in that area in 1917 was evidently due to the extraordinary abundance that year of the Hudsonian lemming (*Dicrostonyx hudsonius*). The chances greatly favor their having been birds reared in northern Labrador. It was at first supposed that the Labrador form of the gyrfalcon was *always* dark, like the bird figured by Audubon in his "Birds of America" (1831:pl.196) under the name *Falco labradora*. Later, Audubon himself, in the "Ornithological Biography" (1834:552), put the name in synonymy, but it was reinstated by Dresser (1876). Dresser acknowledged the presence of light birds in the Labrador Peninsula, but thought that they were stragglers (migrants) and that the dark birds were resident.

The fact is that both light and dark birds breed on the Labrador Peninsula (in Ungava), as we learn from L. M. Turner's notes reproduced by Bendire (1892:282, 286). The U. S. National Museum collection contains a specimen taken by Turner at Fort Chimo, April 1,

1884, and the Carnegie Museum another, shot at Red Bay, Labrador, April 9, 1934. Both of these are white birds, without any spotting below. The dates are a little too early to postulate breeding, but it is highly improbable that these birds were far from their breeding grounds. How far south this form breeds is problematical. Audubon's circumstantial account would indicate a breeding range extending to the Gulf of St. Lawrence, but his record has not been confirmed by any other observer. It may have represented an outlying pair of gyrfalcons which for some reason remained far south of their usual summer home. That the gyrfalcon is a regular breeding species on the north shore of the Gulf of St. Lawrence we do not for a moment believe.

At first sight, it would seem that a fairly good case can be made out for the racial distinctness of the Labrador birds as compared with those of Greenland. However, the differences are obvious only in the dark phase; birds in the light phase are indistinguishable. Breeding specimens in the dark phase average somewhat darker (both above and below) than Greenland birds. In this phase the relationship of these birds to *Falco rusticolus rusticolus* of northern Europe and *F. r. islandus* is obvious. (Apparently neither of these forms has a light phase.) It is in the immature stage of plumage, however, that the differences stand out best. The bird at this stage tends to be dark—a dark brownish black. The extreme is well represented by Dresser's first figure in his article above cited. U. S. National Museum No. 94312, Fort Chimo, September 3, 1883, closely approaches this plate. Our series of September specimens from Fort Chimo show every possible gradation between this particular type of plumage, in which the upper parts, tail, and wings are uniform brownish black, and the under parts similar, with only a few buffy spots and streakings, to the type in which the upper parts are dusky brown with buffy edgings, particularly in evidence on the crown, while the under parts are streaked dusky brown and buffy white, the latter predominating. We regard all these birds as birds of the year; their variations are extraordinary, it is true, but no more so than those shown by birds from Greenland. Dresser, on the contrary, figured and described the darkest birds as adults and the lighter colored ones as immature. His error in this respect was first pointed out by Menzbier and Sushkin (1903).

None of the dark-phase Greenland specimens in the collection of the U. S. National Museum shows any approach to the darkest Labrador birds, but in other plumage phases Greenland and Labrador birds are indistinguishable. In other words, if we were to keep *"candicans"* (Greenland) and *"obsoletus"* (Labrador) as separate races, we would have to admit that only one plumage out of six of *"obsoletus"* would be identifiable and none of *"candicans."* It seems to us, therefore, better to consider them as one form (for which the name *obsoletus* must be

used), explaining that there is a geographical variation in the frequency of white and dark phases and that the darkest immature birds occur only in Labrador.

Some authors attribute considerable taxonomic significance to the variation in color of the bill and feet. But this is apparently an age character (see Witherby *et al.*, 1939, vol. 3, p. 4), the bill and feet of the immature being bluish gray, those of the adult yellow. Carnegie Museum specimens Nos. 57511 and 57512 (both light birds) shot two days apart (September 12, 14) were compared in the flesh. In 57511 the dark markings were streaks (as in immatures) and the bill and feet bluish gray; in 57512 the dark markings were bars (as in adults) and the bill and feet yellow. There are scattered references in the literature to the color of the soft parts as a clue to age (*cf.* Gurney, 1882: 593), but more information is sadly needed.

Swann (1929) tries to show that five plumages of the Greenland bird can be recognized, according to age. He claims that the bird gains its fully adult plumage (the *holbölli* of Sharpe) very slowly. We do not agree. The indications are that the first four stages he describes are merely individual variations of the juvenal plumage. The adult plumage is gained at the first full molt (as in *Falco peregrinus* and other allied species), whether the bird happens to be dark or light. While there may be a tendency toward more decided barring in older birds, Witherby's statement (1921:102, 104, 106) that the adult plumage comes in with the postjuvenal molt seems to us correct.

With Swann's recognition of the European race (*rusticolus*) and Iceland race (*islandus*) we are in full accord. On the other hand, he argues that the Greenland and Arctic American race should be called *sacer*, based on Forster's bird from Severn River, Hudson Bay. In this we do not agree. Forster's bird is not certainly identifiable; very possibly it was *Accipiter atricapillus*, as suggested by Newton—see the preface to the Willughby Society reprint (1882) of Forster's "Animals of Hudson Bay" (1772), p. iv—particularly in view of the bird's breeding at Severn River. It is highly improbable that any gyrfalcon breeds as far south as this point. Swann groups the Labrador birds with those of Arctic America in general, and here we agree.

Discussion

The gyrfalcons are a conspecific group of arctic and subarctic distribution. Inasmuch as the genus *Falco* is cosmopolitan in its distribution, it would seem that the peripheral members of the group probably originated in less peripheral areas than they now occupy. This would imply that the gyrfalcons may well have been originally birds of the north temperate regions. Furthermore, inasmuch as the dark coloration is more widespread in the genus than is extreme whiteness,

it would seem reasonable to assume that the "original stock form" of the gyrfalcons was a dark-colored bird, and that its spread towards the north has been correlated with a tendency towards whitening which reaches its maximum in Greenland and Arctic America. Here there are two color phases, a light and a dark, the relative abundance of which is geographically variable. Inasmuch as the white phase is less developed in Eurasia than in America and Greenland, it seems likely that the ancestral homeland of the gyrfalcons was in temperate Eurasia.

The gyrfalcons of all of North America except for the Bering Sea coast of Alaska are but a single, highly variable subspecies, the picture being complicated by geographical variation, not in the color phases themselves, but in their relative frequency. On the Bering Sea coast a slightly marked, but recognizably distinct race, *uralensis*, occurs. It wanders southward in winter to Washington. It differs from *obsoletus* only in having the seventh primary (fourth from the outside) longer than the tenth (outermost one) whereas in *obsoletus* the seventh is shorter than the tenth.

In Scandinavia (and northern Europe generally) and in Iceland the dark phase only is known as a breeding bird. In Greenland (and Arctic America generally) both light and dark phases occur, the former predominating (except in Labrador). Both phases are highly variable in pattern of plumage. Since they are known to breed in the same area, they must belong to the same race. In Labrador the dark phase predominates, and Labrador birds may be "on the way" to becoming a distinct racial entity.

The evidence that more than one molt is required for the change from immature to adult plumage is not satisfactory. In general, adult birds of both phases tend to be barred crosswise, while the immatures are streaked lengthwise.

Since we consider the name *sacer* of Forster to be doubtfully identifiable, we accept *obsoletus* of Gmelin as the earliest valid name for the race inhabiting Greenland, Labrador, and Arctic America in general. A detailed description of *Falco rusticolus obsoletus* (in the sense here used) is given below. It shows the great complexity and variability of the plumages of this highly interesting bird, and may serve to emphasize the fact that lone specimens or small series are hopelessly inadequate as a basis for judgment of its taxonomic problems.[2]

Falco rusticolus obsoletus

Adult, white phase: Sexes alike. Plumages extremely variable, but generally fall into one or the other of two types. While these two types are well marked, individual birds may combine the characters of the two. Thus, some specimens have some bars on the rectrices but only

[2] The capitalized color terms used in the description are taken from Ridgway's "Color Standards and Color Nomenclature" (1912).

longitudinal streaks on the back and upper wing coverts, and others have some bars on the upper parts and few or none on the tail. Hartert (1913:1065) has suggested that the bar-tailed birds with transverse markings on the back are the older adults, but this not necessarily the case. We have seen nestlings of both the bar-tailed and the plain-tailed types, which, except for the color of the bill and feet, were very similar to adult birds. On the other hand, we have also seen plain-tailed young molting into bar-tailed plumage. The two types may be described as follows:

a. bar-tailed: Entire head, body, wings, and tail white, usually with a faint creamy tinge, the top of the head with narrow Chætura-Black shaft stripes which, on the feathers of the nape, broaden into tear-shaped subterminal spots; interscapulars, scapulars, upper wing coverts, back, rump, upper tail coverts, remiges, and rectrices broadly barred with dark Sepia to Chætura Drab, or even Chætura Black, with only the subterminal band, often somewhat broadly crescentic in shape, visible on the scapulars, interscapulars, and upper wing coverts; the rump and upper tail coverts more narrowly barred; the primaries with broad Chætura-Black apical areas very narrowly edged with white, the dark bars disappearing on the inner webs, which are largely white; the seventh primary (fourth from the outside) shorter than the tenth (outermost); 9 to 11 dark bars, about 10 mm. broad, crossing both webs of the median pair of rectrices, reducing to spots on the other pairs of feathers (where they appear chiefly on the outer webs), and (on the outermost pairs) decreasing in number; lores, cheeks, and auriculars with some fine dusky shaft streaks; chin and throat immaculate white; breast, middle of abdomen, sides, and flanks immaculate white or with a few small tear-shaped spots of Chætura Drab; thighs either flecked or immaculate white; under tail coverts usually unmarked; under wing coverts white with a few tear-shaped Chætura-Drab spots; iris dark brown; eyelid pale flesh; cere light yellow; bill pale yellowish gray, more yellowish at base, and dusky at the tip; tarsi and toes light yellowish gray, claws pale horn color.

b. plain-tailed: Similar to the preceding but with tail immaculate white, the remiges unbarred but with Chætura-Drab shaft stripes broadening into a wide dark apical area as in the barred variety; scapulars, interscapulars, upper wing and tail coverts, back, and rump unbarred but with broad terminally spatulate shaft stripes of Chætura Drab; under parts as in the barred variety.

Adult, gray phase: Sexes alike. Entire upper parts of head, body, wings, and tail Deep Neutral Gray, with or without a dark Sepia tinge, the head feathers with darker gray shaft stripes and often whitish edges, producing a white-streaked appearance; scapulars, interscapulars, back,

rump, and upper coverts of wing and tail with dark shafts and edged narrowly with grayish white to pale buffy white and barred with the same, the light bars widely spaced and variable in their extent, some being reduced to mere spots on the two webs of individual feathers; remiges dark Sepia with a grayish wash, the primaries indistinctly barred or mottled with grayish white on the outer webs and crossed by 15 or more broad white bars on the inner webs, the dark, narrower interspaces becoming incomplete dark bars not always quite reaching the margin of the web, but confluent along the shaft; the ninth primary (second from the outside) the longest, then the eighth, tenth, and seventh; the primaries, with a long terminal unbarred Sepia area on both webs, narrowly tipped with whitish; secondaries incompletely barred with pale grayish to buffy white on both webs, the pale bars not always reaching the shaft; rectrices crossed by 10 to 12 whitish or grayish bands about equal in width to the dark interspaces, the pale bands freckled with Slate-Gray to grayish Sepia; rectrices tipped with white; lores, cheeks, and auriculars whitish, with a creamy wash in some cases, the feathers with Chætura-Drab shaft streaks of variable width (in some cases a pronounced malar stripe results from the widening of the shaft streaks, in others no well-defined malar stripe is present); chin, throat, breast, abdomen, sides, flanks, thighs, and under tail coverts white, generally with a wash of Cartridge Buff or Cream Color, the chin and upper throat usually immaculate, sometimes with dusky shaft streaks; lower throat, breast, and abdomen with dark Sepia shafts widening apically into tear-shaped spots; sides, flanks, and thighs usually with the shaft streaks more pronounced and apical broadening more extensive, even forming transverse bars in some instances; under tail coverts immaculate or marked like abdomen; under wing coverts white, barred broadly with dark Sepia to Fuscous; unfeathered parts as in white phase.

Juvenal, white phase: Sexes alike. As mentioned earlier in this paper, it has been suggested by Swann and other writers that the gyrfalcons pass through a number of plumages between the juvenal and adult stages, but we have seen no slightest evidence of this in a very long series of skins or in the literature or in accounts of birds raised in captivity. To attempt to correlate plumage phases with age is purely arbitrary and pointless.

a. bar-tailed: Variable; similar to the adult but with the Chætura-Black to dark Sepia subterminal crescentic marks on the feathers of the upper surface of the body and wings enlarged to deep wedge-shaped areas covering most of the exposed portions of the feathers, especially of the scapulars, interscapulars, and upper back, producing almost a scalloped effect on these feathers; the shaft streaks on the crown and cheeks generally heavier than in the adult and the tear-

shaped streaks on the under parts heavier and more numerous; the under wing coverts more streaked (with dark Sepia to Chætura Black) than in adults; cere and bill pale Plumbeous; tarsi and toes pale bluish, claws black; orbital skin pale Plumbeous.

b. plain-tailed: Similar to adults but with the brown markings on the scapulars, interscapulars, and upper wing coverts broader; cere and bill pale bluish Plumbeous; tarsi and toes pale bluish.

Juvenal, gray phase: Sexes alike.

a. pale: Variable; entire top of head dark Sepia to Chætura Drab, the feathers with white to pale Avellaneous edgings, sometimes so broad as to reduce the dark color to a mere shaft stripe, in other cases narrow and relatively indistinct (the pale areas usually wider and more noticeable on the nape than on the crown); entire upper parts of body and the upper wing coverts Sepia to dark Sepia, edged narrowly with Drab on dirty white (in some birds these feathers are unmarked, in others they are transversely spotted, or incompletely banded, with buffy white to pale Avellaneous, thus producing two quite different types of coloration—a uniform and a spotted one); primaries with outer webs and tips dark Sepia (the outer webs sometimes faintly mottled with buffy white) and extreme tip whitish, the inner webs whitish except for the tip, the white area taking the form of a series of (about 15) incomplete white bars, which merge at the edge of the web but do not extend inwards as far as the shaft; secondaries plain dark Sepia in uniform-backed birds, marginally crossed by transverse spots of pale Avellaneous to buffy white in the case of spotted-backed birds; rectrices as in gray phase adults but more brownish—Sepia or Chætura Drab to Dark Olive Brown with the pale bars almost Hair Brown on the median pair of feathers and progressively lighter on the inner webs of the lateral feathers; in the case of uniform-backed birds the median pair of rectrices may be almost unbarred; sides of head and neck whitish to pale buff, heavily streaked with dark Sepia, the streaks narrower—merely pronounced shaft streaks—on the cheeks and auriculars, which are sometimes heavily tinged with Drab or Hair Brown; a more or less distinct malar stripe of dark Sepia usually present; chin and upper throat whitish with a cream or buff tinge and with fine dusky shaft streaks which become broader on the throat; rest of under parts whitish like the chin and upper throat but very broadly and abundantly streaked with dark Sepia to Fuscous, the markings usually darkest on the sides and flanks, narrower and paler on the thighs and under tail coverts; under wing coverts whitish, irregularly and incompletely barred or spotted with dark Sepia and usually with dark Sepia shaft streaks; iris dark brown; cere and bill pale Plumbeous; feet pale bluish or pale bluish green; claws black.

b. dark (only females examined): Markings similar to the pale type but much darker; entire upper parts Fuscous, the crown, occiput, and nape often streaked with buffy white; the feathers of the back and upper surfaces of wings edged with dull Sepia but not otherwise marked; primaries with the pale color on the inner webs much reduced, in some cases to a slight freckling, in others to marginal bars not extending more than halfway to the shaft; secondaries uniform Fuscous, unmarked; rectrices dull Fuscous, tipped narrowly with dirty white, the pale bars reduced to transverse spots and often absent save for one or more small subterminal spots on each feather; lores, cheeks, and auriculars dark Fuscous; entire under parts very dark Fuscous to Fuscous Black, the feathers edged with pale buffy white, the edgings often narrow, producing an appearance of narrow pale streaks on the dark background; in other cases much broader, usually broad on the chin and upper throat; the thighs and under tail coverts spotted or barred with buffy white; under wing coverts Fuscous Black or dark Fuscous, the distal median and lesser coverts and all the greater coverts spotted with buffy white. (This plumage phase appears to be confined to Labrador birds, not all of which, however, are of this type.)

Natal down: Said to be white with pale fulvous wash, becoming grayer with age.

Measurements. The average and extreme measurements of 42 adult males and 63 adult females from Alaska, northwest Canada, Baffin Island, Greenland, Southampton Island, and Labrador are shown in Table 1. It should be noted, however, that all the figures probably include a number of young birds in the white plumage in which the ages are indistinguishable.

Breeds from high arctic latitudes in Greenland (both coasts—Angmagsalik; Egedesminde; Etah; Godthaab; Jacobshavn; Kangamint; Nanortalik; Nordletd; Novasak; Oju; Sukkertoppen; Ymer Island); Ellesmere Island (East Bay) and Grinnell Land (Cape Hayes, Cape Frazer, Cape Napoleon—79° 47′ N. Lat.); Baffin Island (Magee Lake; Blacklead Island; Markham Bay; Cape Dorset; Lady Franklin Bay); Digges Island, Hudson Strait; Southampton Island; Victoria Island (Taylor Island); Northwest Territory (Franklin Bay; Cape Bathurst; Bernard Harbor; Coronation Gulf); northeastern and northern Alaska (Point Barrow; Ugashik; Nulato; Collinson Point; Yukon); south to northern Labrador (Fort Chimo; Fort Nascopie; Ungava Bay; Cape Chidley); and northern Newfoundland Labrador (Okak; Nain; Hopedale; Ramah) in the east and to the Atlin region of British Columbia in the west.

Winters more or less throughout its range but wanders very irregularly southward across Canada; Straits of Belle Isle; Nova Scotia; Quebec; Montreal; Ontario; Manitoba (Aweme); British Columbia

TABLE 1

EXTREME AND AVERAGE MEASUREMENTS (IN MM.) OF 105 ADULT * NORTH AMERICAN GYRFALCONS

Locality; number of specimens	Wing	Tail	Culmen from cere	Tarsus	Middle toe without claw
♂					
Alaska	**340**–349	203–215	21.6–23.3	53–58	**45**–48
(4)	(346.0)	(210.8)	(22.6)	(57.1)	(47.6)
n. w. Canada	357–365	**192**–229	**20.0**–23.0	60–**70**	47–50
(5)	(360.2)	(205.6)	(21.2)	(64.0)	(48.3)
Baffin Id.	361–365	195–240	23.0–23.0	**52**–56	50–**54**
(2)					
Greenland	355–**378**	215–241	22.8–24.1	58–68	47–53
(15)	(372.3)	(224.3)	(23.3)	(62.9)	(49.7)
Southampton Id.	355–370	215–235	24.0–**25.0**	60–64	48–49
(3)	(365.3)	(224.3)	(24.3)	(62.0)	(48.3)
Labrador	342–370	203–**244**	20.2–23.0	59–66	47–51
(13)	(360.5)	(221.1)	(21.9)	(62.5)	(49.4)
Series average (42 ♂♂)	364.3	221.5	22.8	62.0	49.2
♀					
Alaska	**368**–**400**	220–259	23.3–26.6	61–64	**48**–53
(4)	(389.6)	(243.8)	(25.2)	(63.4)	(52.0)
n. w. Canada	385–405	235–239	**23.0**–25.5	68–**73**	52–54
(4)	(395.2)	(237.2)	(24.0)	(70.7)	(53.4)
Baffin Id.	395–413	217–253	**23.0**–25.5	65–70	55–**57**
(2)					
Greenland	**368**–**423**	**215**–**266**	**23.0**–**27.9**	**58**–71	50–54
(23)	(410.5)	(227.8)	(25.7)	(62.4)	(52.7)
Southampton Id.	398–408	240–251	25.0–26.0	64–72	52–55
(4)	(404.0)	(244.4)	(25.4)	(68.5)	(53.8)
Labrador	370–412	228–**266**	**23.0**–26.0	63–68	51–54
(26)	(393.6)	(248.8)	(25.1)	(65.6)	(52.9)
Series average (63 ♀♀)	400.5	239.3	25.2	64.7	52.9

* All figures probably include a number of young birds in the white plumage in which the ages are indistinguishable.

The absolute extremes of the male and female series are given in boldface for each measurement.

(Fraser River; Sumas Prairie; Kelowna); and Vancouver Island (Comox) to Newfoundland and the northern United States from Maine (Eagle Island, East Waterford; South Winn; Cape Elizabeth; Katahdin Iron Works; North Deering; Rockland; Brunswick; Spruce Head); New Hampshire (Milford; Exeter); Massachusetts (Northampton; Boston; Breel's Island; Essex; Stowe; Wayland; Melrose; Newton; Ipswich); Rhode Island (Providence; Narragansett; Conanicut Island); Connecticut (Durham); New York (Auburn; Aurora; Bellport, Long Island; Canandaigua; Flushing, Long Island; Monroe Co.; New York City; Pond Quogue, Long Island; Rochester; Rome; Schenectady; Troy; Westchester Co.); and Pennsylvania (Lancaster Co.)

to Michigan (Sault Ste Marie); Wisconsin (Prairie du Sac; Skunk Island); Minnesota (Minneapolis; Madison); North Dakota (Red River Valley; Mandan); South Dakota (Vermillion); Nebraska (Elk Creek); Kansas (Manhattan); Montana (Collins, Teton Co.); Washington (Spokane; Chelan); Oregon (Scio); and the Queen Charlotte Islands, British Columbia. Also to Iceland; the Faeroes; England; Ireland; northern France; and Germany (rarely).

Type locality: Hudson Bay (*ex* Thomas Pennant, "Arctic Zool.," vol. 2, 1875, p. 208).

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THE DEEP DIVING OF THE LOON AND OLD-SQUAW AND ITS MECHANISM

BY A. W. SCHORGER

THE depths to which loons (at least the Common Loon, *Gavia immer*) and Old-squaw (*Clangula hyemalis*) can dive are impressive. On August 27, 1934, I asked Hagen Brothers, commercial fishermen on Madeline Island, Lake Superior, if they ever caught Old-squaws in their nets. They replied that "winter ducks" were taken in 12 fathoms (72 feet) of water, rarely at 15 fathoms; that the real diver was the Loon (presumably *Gavia immer*), since they had taken it at a depth of 30 fathoms (180 feet). There is no definite information on the prey that is sought by the Loon at this depth.

Recently a Common Loon was caught in a net set in Lake Mendota at a depth of about 20 feet. During a discussion of the incident, I mentioned that the Loon had been taken at a depth of 180 feet. The statement was so received as to indicate that the diving ability of the Loon and of the Old-squaw was not common knowledge.

The Common Loon, according to Forbush,[1] is reported to have been taken in fish-nets at a depth of 60 feet. Scott [2] mentions the taking of a loon off the Door Peninsula, Wisconsin, at a depth of 90 feet. Jourdain [3] cites a case of a Common Loon ("Great Northern Diver") caught in a trammel net in 30 fathoms of water. The greatest depth is recorded by Roberts:[4] a fisherman living at the mouth of the Cascade River, Minnesota, stated that he had netted loons at a depth of 200 feet in Lake Superior.

The Old-squaw is taken frequently in the Great Lakes in gill-nets set at depths of 15 to 27 fathoms (90 to 162 feet).[5] A fisherman at St. Joseph, Michigan, told Barrows [6] positively that he had taken Old-squaws repeatedly at a depth of 30 fathoms (180 feet); and Butler [7] reported that they were taken frequently at Michigan City, Indiana, at the same depth.

Ex-Governor Hoard of Wisconsin informed Forbush [1] that this duck is taken frequently in nets set at depths of 50 to 100 feet. Forbush comments: "Probably few species of diving birds reach such depths in pursuit of food." The depths reached, according to Kortright,[8] would be unbelievable were it not for the many well-substantiated records. Apparently the Old-squaw can dive as deeply as the loon. Tarrant [9] was told by Capt. Nathan Saunders that he had caught "ducks" on lines set in Green Bay, Wisconsin, at a depth of 200 feet.

The number of Old-squaws that have been netted at times is very large but not beyond belief when it is considered that some of the nets used are over 8,000 feet in length. Bacon [10] records that fishermen at Dunkirk, New York, have taken from 5,000 to 7,000 Old-squaws at

one haul. Lake Erie being comparatively shallow, most of the ducks were taken at a depth of 15 fathoms, and some at 18 to 27 fathoms. According to his personal knowledge, the largest single haul at Erie was 800 ducks. A single haul on the Great Lakes in December 1934 yielded 1,500 Old-squaws.[8]

Some figures on the number of Old-squaws taken in the waters of the Door Peninsula have been published by Scott:[2] 80 were taken at a depth of 90 feet; 12 at 115 feet; and 16 at 120 feet. There is a recent illustrated note[11] on the netting of these ducks in Lake Michigan, off Saugatuck, Allegan County, Michigan. One haul has produced 400 to 500 ducks. Most of them were taken in nets set for whitefish at depths of 8 to 16 fathoms, but it is not uncommon to find them in nets set for lake trout at a depth of 30 fathoms. I received a letter from R. W. Sewers, Saugatuck, in which he states: "We take these ducks in our nets at depths ranging from 30 feet of water to 180 feet and once in a great while at depths over 200 feet. . . . Last year [March, April, and part of May, 1946] I caught 27,000 of these ducks."

The annual loss of Old-squaws through unavoidable netting is tremendous, and exceeds vastly the number killed by hunters. Dr. W. E. Saunders, who investigated this phase of the subject in 1917, found 12 tons of these ducks at one fertilizer factory. Estimating 1,500 birds to the ton, there were approximately 18,000 in the lot.[8] R. W. Sewers gives away many of the ducks for food though the edibility of this species is low. The remainder are buried. Years ago his father obtained $1.25 per dozen for them in the Chicago market. The present law prevents the sale of wild ducks, but here is a special economic problem that deserves immediate consideration.

The depths to which birds can dive is a controversial point. Dewar[12] concludes that there is no reliable record of a bird diving to a depth greater than 10 fathoms (60 feet), but admits the possibility that some species may descend to greater depths. He dismisses the records of birds caught in nets at depths greater than 10 fathoms with the suggestion that the birds became entangled in the net while it was being raised. Irving[13] considers that the diving ability of certain birds " has probably been overrated on account of their skill at concealment when emerging." Taking into consideration the number of records and the number of Old-squaws that have been taken in nets set at great depths in the Great Lakes, it is wholly improbable that they were all caught during the raising of the nets. Dr. Robert Cushman Murphy writes: "I believe that Dewar is over-conservative in doubting avian diving records of depths greater than 60 feet. There are too many known cases of Old-squaws and other diving birds being found in lobster pots, etc., at depths as great as 240 feet."[14]

Advances in knowledge of the physiology of diving birds in recent years permit us to conclude that birds can dive to great depths, and

to explain the mechanism whereby this feat is accomplished. A careful study of the problem forces the conclusion that the diving bird must be capable of reducing its specific gravity to, or appoximately to, that of water. Having accomplished this change, the amount of energy required to move through the water is reduced to a minimum. Everyone who has watched grebes has observed that they can submerge the body with scarcely a ripple. Townsend remarks that the Horned Grebe (*Colymbus auritus*) "disappears suddenly with a vigorous kick, or mysteriously and quietly *sinks* in the water." [15]

The ability of a bird to contract its body is illustrated by the observations of Audubon on the Least Bittern (*Ixobrychus exilis*): "Replacing it on the table, I took two books and laid them so as to leave before it a passage of an inch and a half, through which it walked with ease. Bringing the books nearer each other, so as to reduce the passage to one inch, I tried the Bittern again, and again it made its way between them without moving either. When dead, its body measured two inches and a quarter across, from which it is apparent that this species . . . is enabled to contract its breadth in an extraordinary degree." [16]

The suggestion that water birds can change their specific gravity was advanced over a century ago. Atkinson [17] thought that the Gallinule ("moorhen"—*Gallinula chloropus*) remained submerged by grasping vegetation with its feet. A distinct contribution was made by Slaney [18] when he proposed that diving birds have the power to expel air from the body cavities prior to submergence. Reduction in specific gravity could be accomplished by expulsion of the air or by reducing the volume of the air by compression. The latter method was favored by Morris.[19] Foottit [20] thought that the specific gravity could be controlled by the extent to which the plumage was contracted by the muscles of the skin.

The observations of Coues on the Horned Grebe are pertinent: "I once noticed a singular fact connected with the power these birds have, in common with other Grebes, of sinking quietly into the water. By the respiratory process they are able to very materially reduce or enlarge their bulk, with the consequence of displacing a varying bulk of water, and of so changing their specific gravity. Once holding a wounded Grebe in my hand, I observed its whole body to swell with a labored inspiration. As the air permeated the interior, a sort of ripple or wave passed gradually along, puffing out the belly and raising the plumage as it advanced. With the expiration, the reverse change occurred from the opposite direction, and the bird visibly shrunk in dimensions, the skin fitting tightly and the feathers lying close." [21]

The extent to which the body of a bird is expanded by inhalation and contracted by exhalation is shown clearly in the paper by Zimmer [22] (See Figure 1).

The problem of diving is stated succinctly by Dr. Stresemann: "In order to force under water their specifically lighter bodies, some species must make use of the acceleration to be obtained by a steep dive or by a free fall. . . . A protracted immersion of the body through natural strength requires special construction not only in the motor, but also in the respiratory apparatus; hence the task of the extremities to shove the bird under water must be facilitated by contrivances that make possible a controlled decrease in specific gravity. The diving birds have this arrangement in their very large inspiratory air-sacs, which can be emptied at need by application of pressure on the abdomen. After exhalation the diving bird is specifically heavier than the swimming and land birds, for the decrease in pneumaticity of the skeleton runs parallel with the increase in diving ability. This pneumaticity is extremely slight in *Podiceps* [= *Colymbus*] *cristatus, Mergus, Phalacrocorax* (in contrast to those *Steganopodes* [= Pelecaniformes] that do not dive) . . . and disappears completely in *Colymbus* [= *Gavia*] and *Fratercula*. In addition, many diving birds are able to reduce their buoyancy by compression of their plumage, i.e., by pressing the enclosed air from the cloak of feathers." [23]

Frogs can regulate their specific gravity by the amount of air held in the sac-like lungs.[24] Seals frequently, if not normally, exhale prior to diving.[25] Data on the specific gravity of birds during submergence are greatly needed. It would be a comparatively simple experiment to determine the specific gravity during diving by weighing the bird and determining the volume of water displaced by submergence, preferably voluntary. Stubbs [26] found the absolute specific gravity of a freshly killed Little Grebe (*Poliocephalus ruficollis*) to be 0.86; the bulk specific gravity (the bird dry and clean with plumage unruffled and the aerial envelope kept as large as possible), 0.66; and the apparent specific gravity (the bird with feathers bound down with fine yarn in as natural a position as possible), 0.84. A Little Grebe weighing 6 ounces

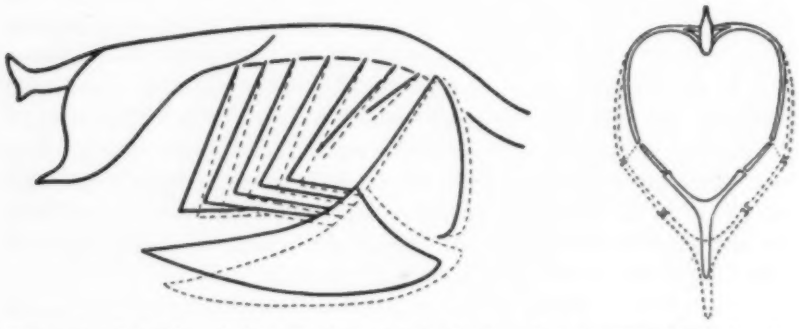

Figure 1. Lateral and frontal views of the body of a standing bird showing change of volume during expiration and inspiration. After Zimmer.[22]

and having a volume of 13 cubic inches, lost 2.24 cubic inches in the volume of its feathers under the above conditions. The method by which the specific gravity was determined is not stated. Unfortunately the above data give only a suggestion as to the actual specific gravity of the bird while submerged.

The submerged bird is apparently lighter than water. Forbush [27] mentions wounded ducks that dived and died while entangled in vegetation. They rose to the surface when set free. R. W. Sewers informed me that 95 per cent of the Old-squaws when taken from his nets will sink in water. The nets are down from 24 hours to 10 days. Some of the ducks are still warm when taken into the boat. Those that have been held under water until the plumage has become completely saturated will sink. The buoyancy of others seems to be due entirely to the small amount of air retained by the feathers. There is no evidence that water enters the interior of the duck after it has died. There is good reason for believing that the apparent specific gravity of the bird would be greater than that of water if the down feathers were completely free from air.

The absence of pneumaticity in the skeleton of the loon was mentioned (by Stresemann) above. Dr. Alexander Wetmore kindly examined the skeleton of the Old-squaw and reported that the coracoid and scapula are pneumatic, but the bones of the wing and leg are not.

Aside from the ability of the diving bird to adjust its specific gravity, there must be considered the time factor in reaching great depths and the supply of oxygen through which most of the energy is produced. Stresemann [23] states that the dive of birds seeking food seldom lasts more than 90 seconds or exceeds a depth of 10 to 12 meters (32.8 to 39.4 feet). The longest dive for the Old-squaw that I have found recorded is 70 seconds, and the depth of the water was about 35 feet.[28] This would be a speed of only about one foot per second, but we are unaware of how much time was spent on the bottom. Dewar's rule requires 20 seconds for the first fathom and 10 seconds for each additional fathom. On this basis it would require approximately 6 minutes for a bird to reach a depth of 200 feet and return to the surface. A dive of this duration has not been recorded for the Old-squaw; however a wounded Common Loon was alive after 15 minutes of forced submersion, according to Jourdain,[3] who cites other cases of immersion lasting 8 to 10 minutes. Eaton [5] observed that the Horned Grebe could remain submerged for three minutes; and Forbush [27] thought that diving birds in general could remain under water for that length of time.

Dewar [12] gives the "average inclusive speed" of the diving bird under water as between one and two feet per second, but mentions a record of four feet per second for the Great Crested Grebe (*Colymbus cristatus*). Some of the diving birds show remarkable speed under

water for brief periods. Coues [21] states that the Pacific Loon (*Gavia arctica pacifica*) shot through the water with "marvellous swiftness." Regarding Holboell's Grebe (*Colymbus grisegena holböllii*), Cahn wrote: "The speed which is developed under water is marvelous, at times it being almost impossible to follow its movements, which were so rapid that the bird appeared more like a large, gray fish darting about." [20] In one case the grebe remained under water for over a minute and reappeared more than 200 feet distant. It is evident that a bird with sufficient incentive can travel under water at far greater speeds than have been assumed.

The grebes and mergansers, according to Brewster,[30] do not compare with the loon for swiftness and distance traveled under water. He shot a loon with a .44 caliber rifle and gives the following remarkable example of vitality: ". . . the heavy bullet passed directly through the middle of her neck, about three inches above the body, partially shattering some of the vertebrae and cutting the jugular vein, yet she dove twice after receiving this ghastly wound, going each time a long distance under water. When I finally came up with her, she was swimming on the surface with head and neck erect and so vigorously that I had to make use of my shot gun before I could lay hands on her." Jourdain [8] mentions that a wounded Common Loon, attached by a line to a 13-foot boat, was able, while submerged, to tow the craft.

Disbelief in the capability of birds to dive to great depths has been based on false assumptions as to the source of the oxygen required. Forbush [27] believed that preparatory to a dive the bird filled its lungs with air; and that "extreme propulsive efforts" were required to force the buoyant body through the water. Dewar [12] states that the maximum vital capacity is "controlled initially by the amount of respirable air the bird can breathe into its lungs and air-sacs." This is not the case.

Oxygen needs of the diving bird are met in a way differing decidedly from that of the non-diver. Krogh says: "The main difference between a diver and a non-diver appears to be in the regulation of the circulation which allows the diver to reduce greatly the blood-flow to the muscles and perhaps also to the other organs and to reserve the supply mainly for the central nervous system." [31] The diver is also much more resistant to carbon dioxide than the terrestrial animal and can withstand breathing 5 to 6 per cent oxygen for a long time. During submergence the diving bird places little dependence on free oxygen. The main source of oxygen is the oxyhemoglobin and oxymyoglobin stored in the muscles. The dark color of the flesh of waterfowl is due to these substances. This oxygen is loosely combined chemically and becomes readily available when needed. Not only has the diving bird a high tolerance for carbon dioxide, but, as the tension of this gas increases, more oxygen is liberated from the oxyhemoglobin.

Further energy is derived from the formation of lactic acid from the glycogen in the tissues without the intervention of oxygen. The oxygen debt created cannot be paid until the bird rises to the surface and resumes normal respiration.

The ability of aquatic birds to prolong life under involuntary submergence is extraordinary. When the domestic duck was held under water, Bert [32] found that it would resist asphyxiation for a maximum of 16 minutes. Richet [33] closed the trachea with a ligature and extended the survival to 27 minutes. The longer survival in this case was attributed to the air forcibly retained in the lungs and air-sacs. The domestic duck is a "puddler"; different data are to be expected for a diving duck. Land animals when submerged expend their energy in violent effort. The contrary is true in general of aquatic animals. Bert observed that the domestic duck when forced under water usually remained still and endured asphyxiation quietly. A hen struggled and survived but 3.5 minutes. The Old-squaws netted in the Great Lakes die without struggling. The nets are torn only by the weight of the birds when the nets are lifted or during the removal of the entangled birds.

Paton [34] and Huxley [35] made the interesting discovery that posture produces apnœa, i.e. partial suspension of breathing. When a duck dives with neck extended, apnœa follows automatically. Apnœa also results from posture without contact with water. However, in air, regardless of the position of the body, if the duck can turn its head so that the dorsal surface is upward, breathing can be resumed. Ostensibly the essential difference between flight and diving posture is that one is horizontal and the other vertical. However, contact with water may also play a part in producing apnœa since the Common Loon will travel submerged a long distance in shallow water, where it must take a horizontal posture.

There are apparently no physical or physiological reasons why some exceptionally skillful individuals among diving birds cannot descend to a depth of 200 feet. There is ample evidence that this depth is actually reached.

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SEASONAL FLUCTUATIONS IN WEIGHTS OF PENGUINS AND PETRELS

BY L. E. RICHDALE

FROM August 1936 to May 1946 I carried out a banding study of the Yellow-eyed Penguin, *Megadyptes antipodes*, on the Otago Peninsula, New Zealand. In all, I paid 973 visits to the breeding areas, which are 20 miles from the city of Dunedin with the outermost colonies 20 miles apart. The observations concerned 88 male and 96 female penguins which were found breeding for at least one season. A total of 292 matings was noted.

Weights were recorded as often as possible throughout the year. Finally, in the tenth season, weights were taken at 7-day intervals, from a point 56 days before the deposition of the first egg to the end of the guard stage, when the chicks are abandoned in the daytime and the two parents fish simultaneously.

In addition, seasonal weights were taken of two species of petrels—the Broad-billed Prion, *Pachyptila vittata* [= *forsteri*] and the Diving Petrel, *Pelecanoides urinatrix*. These weights were taken with much less thoroughness, but even so, the results should indicate general tendencies and serve for comparison. The petrel research was carried out on the tiny island of Whero off the southeast corner of Stewart Island.

In conclusion, I have compared the weights of the petrels and penguins with the findings of other workers on other species. This paper owes its inspiration largely to the researches of Wolfson (1945). My thanks are due to Mr. R. K. Wilson, who drew the graphs.

Weight Fluctuation in the Penguin Megadyptes

The weekly weights of the penguin *Megadyptes* are given in Tables 1 and 2; their differences are worked out statistically in Table 3. There is little difference from week to week; only 7 of the 42 differences are significant.[1] Four other types of interval were worked out. In weights taken at two-weekly intervals (Graph 1), 9 differences out of 20 are significant; at three-weekly intervals, 5 out of 12; and the division of each stage into two equal parts gives 5 significant differences out of 10. It will be observed that as the intervals are widened the differences in weight tend to become statistically more significant. A further tendency, however, is for significant phases in the breeding cycle to be obscured.

[1] Before allowing that a difference between means is significant, I have followed the ruling that it must be at least four times the value of the probable error of the difference.

In an endeavor to obviate this factor, I made a final broad grouping, as shown in Graph 2. All but one of the eight differences are significant, and the one exception is nearly so. One important point, however, is hidden. This is the fact that the females are heavier than the males for four weeks preceding the laying of the first egg, a phenomenon best appreciated by the use of weekly intervals as shown in Tables 1 and 2. Graph 2 shows several points between 56 days before the first egg and 48 days after hatching where a change in weight occurs that is significant statistically. Moreover, a close study of the behavior of the sexes during this period shows a correlation with the statistics.

The period from 42 days before laying to the laying of the first egg is best discussed in weekly intervals, since wider intervals fail to reflect important changes in behavior. In the interval 42–36 days before egg-laying, the males have reached their heaviest weight, after which a steady decline occurs till the end of the pre-egg period, when

TABLE 1

MEAN WEEKLY WEIGHTS OF MALE PENGUINS FROM 56 DAYS BEFORE EGG TO END OF GUARD STAGE

Stage	Class interval	n[1]	Mean	σ[2]	PE_m[3]	Range
	days		lbs.	lbs.		lbs.
Pre-egg	56–50	4	14.13	.70	.23	13 –14¾
	49–43	2	13.38	.22	.10	13¼–13½
	42–36	9	14.22	.45	.10	13½–14¾
	35–29	10	13.82	.83	.17	12½–15½
	28–22	7	12.50	.77	.20	11¾–14¼
	21–15	13	11.96	.46	.08	11 –12¾
	14– 8	17	11.57	.72	.11	10½–13
	7– 1	17	11.47	.50	.08	10½–12¼
Post-egg	0– 6	20	12.04	.61	.09	10¾–13
	7–13	33	11.93	.84	.09	10½–14¾
	14–20	16	11.90	.73	.12	11 –13¾
	21–27	18	11.79	.59	.09	10¾–12½
	28–34	21	12.33	.91	.13	11¼–14
	35–41	25	12.57	.60	.08	11½–13¾
	42–48	20	12.27	.61	.09	11 –13½
Guard	0– 6	31	12.51	.85	.10	11 –14¾
	7–13	26	12.59	.84	.11	11½–14
	14–20	27	12.12	.91	.11	10½–14
	21–27	25	11.74	.58	.07	10¾–13
	28–34	22	11.47	.59	.08	10¼–13¼
	35–41	21	11.62	.97	.14	10½–14¼
	42–48	12	11.91	.83	.16	10½–12½

[1] n = number of weights taken.
[2] σ = standard deviation.
[3] PE_m = probable error of mean.

TABLE 2

MEAN WEEKLY WEIGHTS OF FEMALE PENGUINS FROM 56 DAYS BEFORE EGG TO END OF GUARD STAGE

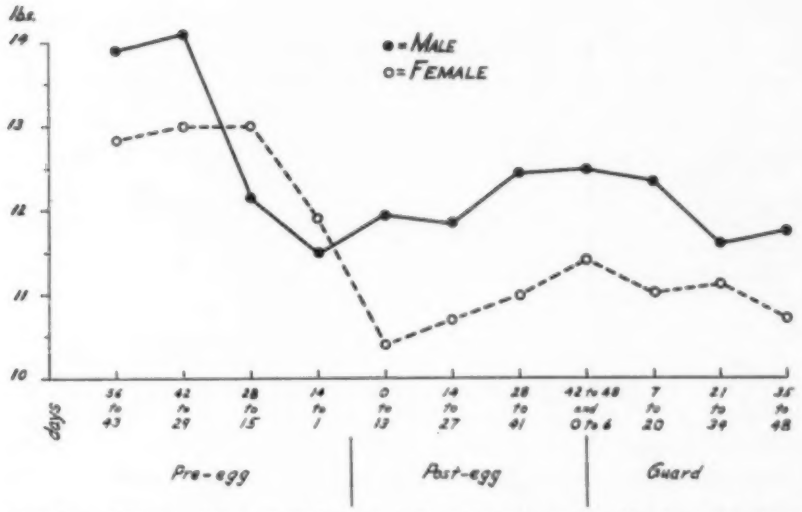
Stage	Class interval	n[1]	Mean	σ[2]	PE_m[3]	Range
	days		lbs.	lbs.		lbs.
Pre-egg	56–50	3	12.58	.33	.13	12¼–13
	49–43	2	12.75	—	—	12½–12¾
	42–36	3	11.92	.66	.25	11 –12½
	35–29	4	13.81	.72	.24	12¾–14¾
	28–22	5	13.30	.56	.17	12¾–14¼
	21–15	11	13.05	.62	.12	12 –14
	14– 8	21	12.20	.62	.09	11 –13¼
	7– 1	18	11.57	.63	.10	10½–12¾
Post-egg	0– 6	39	10.42	.52	.06	9 –11½
	7–13	17	10.40	.48	.08	9¾–11
	14–20	22	10.76	.55	.08	10 –12¼
	21–27	16	10.59	.53	.09	9½–11½
	28–34	16	10.94	.79	.13	10 –12¼
	35–41	19	11.19	.63	.10	10¼–12
	42–48	21	11.29	.61	.09	10¼–12½
Guard	0– 6	34	11.46	.62	.08	10 –12½
	7–13	26	11.26	.85	.11	9¾–13
	14–20	24	10.84	.67	.09	9¾–12¼
	21–27	17	11.88	.62	.10	10 –12
	28–34	27	11.27	.94	.12	9¾–13½
	35–41	20	10.87	.51	.08	10 –12
	42–48	22	10.43	.52	.07	9¾–11½

[1] n = number of weights taken.
[2] σ = standard deviation.
[3] PE_m = probable error of mean.

their weight tends to increase. From 40 days before the egg appears, the males begin to stay ashore in the daytime, and they remain there for much longer periods than the females. Although some of the females begin to stay ashore quite early, they spend far more time than their partners at sea, fishing. Because of this fact, the females continue to increase in weight till the 35–29 day interval.

The result is that the weights of the two sexes in the 35–29 day interval are nearly equal. After this interval the males are lighter than the females till the last week of the pre-egg period, when the weights are once more equal. In the 21–15 day interval, females are on the average slightly over one pound heavier than males.

With the appearance of the first egg, the story changes abruptly. In the 7–1 day interval before egg-laying, the males begin to seek food more often and the females tend to remain ashore. For some days after the first egg is laid the females rarely enter the water and the males seldom stay ashore in the daytime. (There are, of course, exceptions to this general rule.) Thus the females reach their lowest



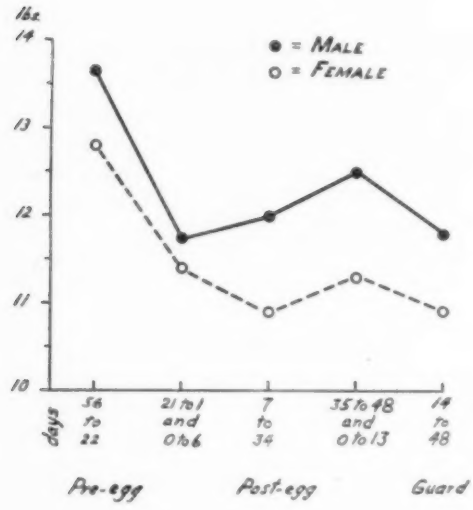
Graph 1. Mean weights of Yellow-eyed Penguins at two-weekly intervals from 56 days before egg-laying to the end of the guard stage.

TABLE 3

DIFFERENCES IN WEEKLY MEANS TAKEN FROM TABLES 1 AND 2

Intervals	Male		Female	
	Difference	PE_d[1]	Difference	PE_d[1]
	lbs.		lbs.	
56–50 and 49–43	.75	.251	.17	.130
49–43 and 42–36	**.84**	.141	.73	.250
42–36 and 35–29	.40	.197	**1.89**	.346
35–29 and 28–22	**1.32**	.262	.51	.294
28–22 and 21–15	.54	.215	.25	.208
21–15 and 14– 8	.39	.136	**.85**	.150
14– 8 and 7– 1	.10	.136	**.63**	.134
7– 1 and 0– 6	**.57**	.120	**1.15**	.116
0– 6 and 7–13	.11	.127	.02	.100
7–13 and 14–20	.03	.150	.36	.113
14–20 and 21–27	.11	.150	.17	.120
21–27 and 28–34	.54	.158	.35	.158
28–34 and 35–41	.24	.152	.25	.169
35–41 and 42–48	.30	.120	.10	.134
42–48 and 0– 6	.24	.134	.21	.144
0– 6 and 7–13	.08	.149	.20	.136
7–13 and 14–20	.47	.162	.42	.142
14–20 and 21–27	.38	.130	.04	.134
21–27 and 28–34	.27	.106	.39	.156
28–34 and 35–41	.15	.163	.40	.144
35–41 and 42–48	.29	.213	.34	.106

[1] PE_d = probable error of difference.
Statistically significant differences are given in boldface.



Graph 2. Mean weights of Yellow-eyed Penguins at wide intervals from 56 days before egg-laying to the end of the guard stage.

weight level during the first two weeks after the egg is laid, whereas the males reach theirs before the egg is laid.

From these respective depression points the weights of both sexes gradually increase during incubation until the highest peak in weight for the post-egg period is reached in both sexes (during the interval from 42–48 days post-egg to 0–6 days guard). Soon after the parents begin to feed the chicks, a decline occurs. This seems to indicate that even though the parents themselves acquire food daily (which they did not during the incubation stage), the additional task of feeding the chicks has an adverse influence on their weight. At the end of the guard stage, weights of the adults have once more reached a low level.

The graph for the guard stage tends to be irregular. This is the most difficult period for which to obtain an even sampling, since there is a great disparity in weight between a bird that has been ashore for nearly 24 hours and one that has just returned from feeding. The true test would be to weigh the birds at a definite period, say five or six hours after they had returned home. This, however, would be an almost impossible task.

Weight Fluctuation in Petrels

Before attempting to interpret Tables 4, 5, and 6 it will be advisable to summarize briefly the behavior of the species concerned; more detailed accounts have already been published (Richdale, 1943, 1944, 1945). *Pachyptila* will be dealt with first. The period from May 12

TABLE 4

SEASONAL WEIGHTS OF THE BROAD-BILLED PRION

Periods	Remarks	n[1]	Mean	σ[2]	PE_m[3]	Range
			gms.	gms.		gms.
May 12 to 20	Winter months	13	206.6	14.75	2.73	177 to 227
Aug. 24 to Sept. 2	Laying begins end of August	19	189.4	16.65	2.54	160 to 220
Dec. 6 to 16	End of chick-feeding stage	27	189.8	17.65	2.26	170 to 234
Feb. 7 to March 7	All in molt	22	197.2	13.70	1.92	172 to 225

[1] n = number of weights taken.
[2] σ = standard deviation.
[3] PE_m = probable error of mean.

to May 20, as shown in Table 4, is the middle of the off-season. All the birds handled during this period had completed their molt, but their breeding status was unknown. In the winter months *Pachyptila* visits the shore at irregular intervals.

August 24 to September 2 marks the end of the pre-egg stage and the beginning of laying. One or two of the 19 birds weighed during this period were incubating; the breeding status of the others was unknown.

The adults caught between December 6 and 16 were all feeding chicks (which were near the end of their stay in the burrows). Some adults were caught before they had fed their young and others afterwards. Since chicks may receive up to 80 grams of food in a night (Richdale, 1944:194), the range in weight of feeding adults is very wide.

Finally, the span between February 7 and March 7 is the time the molt occurs. On February 7, 1942, I was present when *Pachyptila* made its first appearance on the island since the completion of the breeding season a little more than a month earlier. All individuals inspected were molting, and all showed considerable wear on the toes—

TABLE 5

DIFFERENCES IN SEASONAL WEIGHTS OF THE BROAD-BILLED PRION

Periods	Difference	PE_d[1]
	gms.	
Between May and August	17.2	3.73
" August and December	.4	3.40
" December and February	7.4	2.96
" February and May	9.4	3.35
" December and May	16.8	3.54

[1] PE_d = probable error of difference.

indicating that they were old birds. Their breeding status was unknown.

For *Pelecanoides* (Table 6) only two periods are available. The first extends from August 23 to 26, which probably represents the beginning of the pre-egg period. The birds were all caught and weighed at night just after they had landed. Some were known to be breeding birds, but others were unbanded. Those handled between December 22 and January 30 were all attending chicks and were caught sometimes before and sometimes after they had fed the chicks. For this reason a wide range in weights is apparent.

TABLE 6

SEASONAL WEIGHTS OF THE DIVING PETREL

Periods	Remarks	n[1]	Mean	σ[2]	PE_m[3]	Range
			gms.	gms.		gms.
Aug. 23 to 26	End of winter months	26	136.15	6.25	.83	125 to 152
Dec. 22 to Jan. 30	Chick-feeding stage	100	124.10	10.27	.68	108 to 158
	Difference		12.04	±1.07		

[1] n = number of weights taken.
[2] σ = standard deviation.
[3] PE_m = probable error of mean.

The difference between the December and February weights of *Pachyptila*, as shown in Table 5, is not significant as it stands. When it is realized, however, that the December weights include, in some cases, a quantity of undelivered food for the chicks, it is clear that the real difference would be much greater and possibly significant. This suggests that the month at sea during which the molt commences is a period of recovery from the stress of feeding young.

During the period of molt, February 7 to March 7, individuals were weighed on four occasions. These weights did not show any significant difference. If this represents the true state of affairs, *Pachyptila* does not lose weight while molting.

In *Pachyptila* the difference between the May and December weights is significant. May is the middle of the off-season, and the weights would probably be much higher at the beginning of the pre-egg stage, about the end of July. This is the case in *Pelecanoides*, which also shows a significant difference between the early pre-egg stage and chick stage weights (Table 6). It would seem, then, that weights in *Pachyptila* and *Pelecanoides* rise during the off-season to a peak at the beginning of the pre-egg stage and drop to a low point during the feeding of the chicks.

Finally, Table 4 also indicates that, as in *Megadyptes*, there is a depression point at the end of the pre-egg stage in *Pachyptila*. This

is corroborated by the fact that there is a significant difference between the May and the late August weights.

Discussion

According to Baldwin and Kendeigh (1938:431, 435) most species of birds show a maximum weight in winter and early spring and a decrease at the approach of the breeding season. Nice's observations (1937:25–26) on Song Sparrows, *Melospiza melodia,* were similar. Marples (1942 and 1945) indicates a similar trend in the Little Owl, *Athene noctua,* and in the Wax-eye, *Zosterops lateralis.*

Wolfson (1945:109–121), however, objects that these generalizations are only partially true. He states that there is in Oregon Juncos, *Junco oreganus,* and other passerines a significant correlation between an increase to a maximum body weight and the beginning of the spring migration. He produces convincing evidence in support of his contention. His impressive graph (p. 120) indicates that, in the spring, migrants increase rapidly in weight, whereas residents continue to decrease. Further, he points out that the increase in weight of the migrants is due to the deposition of fat, subcutaneously and intraperitoneally (p. 109).

The statements of Wolfson are interesting in view of what happens in *Megadyptes.* Not only is there a tendency to follow the same pattern of weight fluctuations as migrant passerines, but also, heavy deposits of fat develop as the breeding season approaches.

From the beginning of winter to six weeks before egg-laying, there is a gradual steady increase in weight and fat deposition in both sexes. This is true not only of the group of penguins as a whole recorded in Graph 1, but is also true, in the main, of the individuals that I was able to weigh several times during the period. Further, although no birds were collected for autopsy, it was obvious that the males, in particular, were extremely fat by August 24, the beginning of the pre-egg stage. Even their ability to walk was impaired.

Side by side with this gradual development there is manifested a growth in the testes and presumably in the ovary. Dissection of two males killed by a fall of rock toward the end of the winter period showed that the testes were much enlarged. The physiological state of the penguins eventually reached a condition that allowed them to stay ashore for a time without food.

Doubtless there are external as well as internal factors which help to bring about these changes culminating in the pre-egg stage. If so, these external factors, one of which is probably the increase in day-length, apparently act differently on the two sexes. The females reach their peak weight and fat deposition later than the males and are later in beginning to stay ashore in the daytime; they do not, at first, fast as frequently as the males. Wolfson (p. 110) found a comparable situ-

ation in migrant passerines, a fact which explains why females arrive on the breeding grounds later than the males.

To sum up, it will be seen that in *Megadyptes* a steady increase in body weight and fat deposition precedes the pre-egg stage and that the females lag behind the males. The sexes, in this way, are prepared for the behavior patterns which will be released in the succeeding period. This preparation occurs at the correct time presumably because of the response of the endocrine glands to external factors in the environment. The response of the endocrine system then causes a change in the metabolism which results in an accumulation of surplus fat.

During the last four weeks of the pre-egg stage the female *Megadyptes* is heavier than the male (Tables 1 and 2). The reason for this is noted above and is not caused by the advent of the eggs, which average about 136 grams and are laid four days apart. In the third week before laying, occurs the greatest disparity in weight between the sexes, when the females average a little more than one pound heavier.

This advantage in female weight in species in which the male is the heavier during most of the year has been recorded elsewhere. When occurring just before laying it has been thought to be due to the presence of the eggs (Nice, 1937:27;1938:7. Marples, 1942:247). Another possibility is that the male's weight may tend to fall because of his greater activity, especially noticeable in species which are highly territorial. Such a possibility is suggested by Nice (1937:25).

In species in which only the female incubates there are records that she continues to be heavier even after the eggs are laid and during the subsequent incubation. Nice (1937:26–27; 1938:7) found this tendency in Song Sparrows. She also quotes Riddle and Braucher as stating that there is an eight per cent rise in weight during incubation in pigeons and doves. From this it would seem that incubation is not the arduous task that some people think. As for the male, in species in which he does not share the task of incubation (so far as records are available), his weight continues to fall. This is recorded in Song Sparrows (Nice, 1937:22) and in the Little Owl (Marples, 1942:247).

In *Megadyptes*, incubation is shared equally by the sexes. The female remains lighter than the male throughout, and, in fact, at the beginning of the period she reaches one of her two lowest depression points. This is due to an increase in fasting toward the end of the pre-egg stage and particularly during egg-laying. From this low level she rises steadily till the eggs are hatched. The male's weight also registers a steady rise. These facts support Nice's view that incubation is a recuperative period. It would seem that in species in which both sexes incubate both male and female gain in weight. If the female alone incubates, the female alone becomes heavier. A knowledge of what happens if only the male incubates, as in the phalaropes, would be of considerable interest.

With the hatching of the chicks there seems to be a general drop in weight for at least those parents which feed the young. This applies to *Megadyptes*. (In this penguin there is a rise again, however, after the end of the guard stage, a condition characteristic of this species and probably of all penguins.) Nice (1937:27) states that feeding young is strenuous in the two sexes for both Song Sparrows and Tree Sparrows, *Spizella arborea*. The same conditions appear to apply in the Little Owl (Marples, 1942:pl. 20).

Finally, weights connected with the molt will be considered. Immediately following the breeding season in autumn, the molt commences for most penguins of both sexes. The greatest amount of fat is developed (being greater than at the end of the winter months) and the heaviest weight of the yearly cycle is attained just as the molt commences, but on completion of the molt the birds register the minimum weight for the year.

As regards other families of birds, Nice (1937:22) indicates that Song Sparrows are "undoubtedly" at their lowest weight in August and September, when the molt occurs. Beck found a heavy loss at this time in four domestic fowls (Nice, 1938:7). In the Little Owl, Marples (1942:247) thinks that the minor loss in weight he recorded in the autumn was due to molt.

The contrary view is held by Baldwin and Kendeigh (1938:463), who say that "molting and renewal of feathers in August and September is not joined with a decrease in weight; rather there is an increase in weight at that time." In support of this, Laskey (Nice, 1938:7) reports the "highest weight during the inactive period of molting" in male Mockingbirds, *Mimus polyglottos*.

In petrels, it would seem from the meagre evidence available that they reach peak weight at the beginning of the pre-egg stage and decrease steadily till the egg is laid. They are again low in weight at the end of the chick stage, and up to this point the graph of their weight closely resembles that of *Megadyptes*. During the molt *Pachyptila,* at least, does not lose weight.

In conclusion, it is obvious that not all species of birds reach their maximum weight in the winter months and then decrease as the breeding season approaches. Some, like the migrant passerines, penguins, and at least some petrels, reach a peak at the beginning of the pre-egg stage. The weight of incubating birds tends to rise; if a bird does not incubate, its weight tends to fall. Parents that feed the young also lose weight, but no data are available on parents that do not feed the young. As regards the molt, some birds—particularly penguins—certainly lose weight during the process. On the other hand, there is evidence that some birds do not and that others even gain weight. It is abundantly clear that data collected on bird weights are of inestimable value in clarifying many physiological and psychological problems.

Summary

In the course of a 10-year study (1936–1946) of the Yellow-eyed Penguin, *Megadyptes antipodes*, weights were taken at 7-day intervals from 56 days before the egg was laid to 48 days after hatching—a period of about 146 days.

Males reach their peak weight at the end of the off-season and drop steadily during the pre-egg stage until just before egg-laying.

Females reach their peak in weight a week later than the males, and for four weeks are heavier than the males, which again exceed the females in weight as the eggs appear.

As incubation progresses, both sexes steadily increase in weight, but another drop occurs during the 48 days after the hatching of the chick.

Weight fluctuations in two species of petrel, the Broad-billed Prion, *Pachyptila vittata* [= *forsteri*], and the Diving Petrel, *Pelecanoides urinatrix*, were also examined. The same pattern of fluctuation seemed to occur in these two species as in the penguin *Megadyptes*.

The results of the study were compared with the findings of other workers on other species. They were found to follow closely the deductions of Wolfson, who studied migrant Oregon Juncos, *Junco oreganus*. They differ, however, from data on non-migratory birds, most of which apparently reach peak weights in the winter.

Megadyptes resembles Juncos in that a heavy deposit of fat develops as the pre-egg period approaches. In both species this is coincident with growth of the gonads.

The pattern of weight fluctuation indicates that incubation in birds is not the arduous task that it is supposed to be, but that feeding of young is a time of stress.

The penguin *Megadyptes* reaches its peak weight for the year at the beginning of the molt, its minimum weight at the end; the petrel *Pachyptila* apparently does not lose weight during the molt. Evidence from other workers on other species indicates that in some birds there is a gain of weight during the molt; in others, a loss; in still others, no significant change.

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GENERAL NOTES

Zone-tailed Hawk breeding along Colorado River.—Since the Zone-tailed Hawk (*Buteo albonotatus*) nests principally in canyons of mountainous country from central Arizona southward, a report of its breeding in the immediate valley of the lower Colorado River on the western border of Arizona is of interest. On July 13, 1946, I found a juvenile Zone-tail, obviously not long out of the nest, perched on a branch of dead mesquite in the Bill Williams River delta, Yuma County, Arizona. At my close approach it made no effort to escape, and when I reached to pick it up, its only defense was to spread its wings and open its bill. I tested its ability to fly by tossing it into the air. It flapped clumsily and came to an awkward rest on a near-by bush. During this time the parent birds were flying boldly overhead, uttering a shrill screaming, and frequently alighting in a large dead cottonwood near by. Upon scanning the cottonwood, I discerned a moderate-sized nest of twigs about 40 feet from the ground in one of the main crotches of the tree. Since there were no other suitable nest trees close by, this was undoubtedly the birds' nest. A thorough search (as thorough as the denseness of the brush would permit) failed to reveal the presence of more than the one juvenile, and from the actions of the parent birds I judged that there were no more.

The general area is an almost impenetrable jungle of dead mesquite (*Prosopis juliflora*) and rank arrowweed (*Pluchea sericea*), from which protrudes an occasional stark, dead cottonwood. Close at hand is a small beaver-dammed stream, flowing through the dead mesquite and arrowweed; further away are willow-cottonwood woodlands and towering cliffs. The nest tree is about half a mile from where the small stream of the Bill Williams River joins the waters of Havasu Lake (impounded by Parker Dam).

In this same restricted area, I had seen Zone-tailed Hawks before: on August 14, 1943, three (including one I thought to be a juvenile); on August 25, 1943, two; on September 7, 1943, two; and on May 29, 1946, one. (I did not visit the area in 1944 or 1945.) My latest fall record for the Colorado River valley is September 16 (1946), when I saw one along the Colorado River, about two miles southwest of Parker Dam, in San Bernardino County, California.—GALE MONSON, *Fish and Wildlife Service, Parker, Arizona.*

Late nests in Yellowstone National Park.—Yellowstone National Park has long been known as a favorite nesting locality for American Ospreys (*Pandion haliaetus carolinensis*). For many years these birds have used Eagle Nest Rock in Gardner Canyon and the lofty pinnacles in the Grand Canyon of the Yellowstone. Apparently one of these picturesque sites has been occupied every year at least since 1875. Skinner, former park naturalist (in A. C. Bent, 1937. *U.S. Natl. Mus. Bull.* 167:359) reported 25 nests on pinnacles of the Grand Canyon during the spring of 1914 and a larger number in tree sites. David de L. Condon, Chief Park Naturalist of Yellowstone National Park (letter of January 7, 1947) wrote that on one trip to the Grand Canyon of the Yellowstone during July 1946 he casually noted 17 nests in use; he added that Ospreys were common nesters throughout the Park, probably about as common as in 1914.

Nest construction and incubation ordinarily take place during May and June. The birds usually produce but one brood in a season, but if their first attempt is unsuccessful they may nest again after an interval of three or four weeks. For the northern part of the United States, Bent (page 361) mentions May 25 as the earliest date recorded for nests containing young and June 18 as the latest date for eggs. In the Yellowstone eggs have hatched during the very last of June. Young Ospreys develop slowly, remaining in the nest from 35 days to 8 weeks.

During the last two weeks, by which time the wings are well developed, the young exercise their wings vigorously. Bent says that the birds may leave the nest as early as July 26, but Yellowstone records indicate that the young may leave any time in August (there are no records of young Ospreys unable to fly after the last of that month). According to Skinner's records (Bent, page 375), October 7 is the latest date on which Ospreys have been recorded in Yellowstone; Condon noted one in the Park on October 7, 1946; he remarked, however, that Ospreys may have remained there much later.

On September 23, 1946, I saw young Ospreys in three nests on pinnacles in the Grand Canyon of the Yellowstone. In one of these nests the young bird was just beginning to emerge from the downy stage. In the other nests the primaries were about half developed. In two hours of observation I did not see the young exercise their wings, a fact which would suggest that they were far from ready to leave the nest. Their size, appearance, and habits indicated that the birds would require at least another two weeks before they could fly.

Other species also were known to nest late in Yellowstone in the summer of 1946. On September 22 and 23, 1946, I noted a female Barrow's Golden-eye (*Glaucionetta islandica*), with her brood of six downy young, on Yellowstone Lake near the "Thumb." The young appeared to be less than two weeks old.

In Yellowstone the mercury is low before the last of September, and snow almost invariably has covered the ground before that time. The cold wet spring of 1946 may have caused failure of the first nesting attempts of these birds, so that the young Ospreys and Golden-eyes noted on September 22 and 23 were probably the result of second nestings.—CLARENCE COTTAM, *Fish and Wildlife Service, Chicago 54, Illinois.*

Another atypical House Wren song.— Along the Greenbelt road near Branchville, Prince George's County, Maryland, on July 10, 1946, I heard a completely unfamiliar song given by a House Wren (*Troglodytes aëdon*). In its fullest version, the song was: three to five *chukka*'s, a *tsuh-swee* (the *swee* rough, yet musical, and rising in pitch), then a typical bubbly wren-song. Sometimes the *chukka*'s were omitted and the song began with the *tsuh-swee;* at other times the bubbly song was omitted and only the first two sections given—it was this version that led me to search the bird out and watch it sing, which I did at only a few yards' distance. Murray (1944. *Wils. Bull.*, 56:49) has reported atypical song by a House Wren in Virginia.—HERVEY BRACKBILL, *4608 Springdale Avenue, Baltimore 7, Maryland.*

Western Palm Warbler in Colorado.—The Western Palm Warbler (*Dendroica palmarum palmarum*) has been listed from Colorado on the basis of one observed by H. G. Smith in Denver on June 20, 1891. We now have a specimen (No. 25375) collected in the State, a female taken near Limon, Lincoln County, by Joseph Stephens, on May 13, 1947.—ALFRED M. BAILEY, *The Colorado Museum of Natural History, Denver.*

An Oven-bird incubates a record number of eggs.—On May 23, 1947, I found a nest containing one egg of the Oven-bird (*Seiurus aurocapillus*) and three eggs of the Cowbird (*Molothrus ater*) in a woods five miles southwest of Ann Arbor, Michigan, where I had previously studied the Oven-bird and the Cowbird (Hann, 1937; 1941. *Wils. Bull.*, 49:145–237; 53:209–221). On the following day, about 11 a.m., I revisited the nest and found the same Oven-bird egg (which I had marked) and four Cowbird eggs. (Three of the Cowbird eggs were quite similar in coloration, being finely mottled with brown, but the fourth was whiter and had larger markings, a possible indication that more than one Cowbird had laid

in the nest.) Since there was still only the one Oven-bird egg in the nest, I supposed that the nest had been deserted; but six days later, on May 30, I found the Oven-bird incubating four Oven-bird eggs and four Cowbird eggs. This was the largest number of eggs I had ever found in one Oven-bird nest. The time of the Oven-bird's laying and the beginning of incubation were, of course, uncertain, but in all probability the second egg was laid on the morning of May 24 (the day of my second visit to the nest) and was taken by a Cowbird before I arrived. If the regular pattern of laying and incubation was then followed, the remaining eggs were laid May 25, 26, and 27, and incubation was started on May 26. In the afternoon of June 8, the eight eggs were still present, and none was pipped. On the morning of June 11, two Cowbirds had hatched; one was about two days old, the other scarcely one day. The larger Cowbird had probably hatched on June 9, and the smaller late on June 10. If incubation began on schedule, the incubation period for these Cowbirds was about 14 and 15 days instead of the average 11.6 days. It is possible, however, that the regular habit of beginning incubation on the day before the laying of the last egg was disturbed by the presence of Cowbird eggs so that incubation was delayed for one or two days. During my later observations, however, the Oven-bird was very attentive and was on the nest three out of four times when I arrived.

On June 15, when the Cowbirds were presumably five and six days old, I took the unhatched eggs to the laboratory. Calculations by water displacement, checked by the volume formula used by Worth (1940. *Auk*, 57:44), showed that the four Oven-bird eggs and four Cowbird eggs had a volume about 1.8 times that of the regular 5-egg clutch of the Oven-bird. Upon opening the eggs, I found that the two Cowbird eggs and one Oven-bird egg had developed well toward the hatching stage, but the remaining three Oven-bird eggs had not gone beyond the early stages of development.

The position of the eight eggs in the nest is important in this connection. The Oven-bird eggs, on May 30, were in the bottom of the nest, and the Cowbird eggs around the edge, above the Oven-bird eggs. On June 8 the arrangement was similar except that one Cowbird egg was at the edge of the bottom layer and an Oven-bird egg was on the edge above. The Cowbird egg that was in the bottom layer was the one with the larger spots and was one of those that failed to hatch.

It is a well-known fact that any very appreciable reduction in the amount of heat delivered to the eggs during incubation, especially during the early stages, lengthens the time required for hatching or is fatal to the embryos (Baldwin and Kendeigh, 1932, Physiology of the temperature of birds, *Sci. Publ. Cleveland Mus. Nat. Hist.*, 3:143–144). The largest number of eggs incubated hitherto by an Oven-bird under my observation was four Oven-bird and two Cowbird eggs. These all hatched, and the young lived to leave the nest, but the incubation period was unknown, since the nest was not found until after incubation had started. The volume of these six eggs that hatched successfully I estimated to be about 1.3 times that of the normal clutch, as compared with the present group of eggs, with 1.8 times the normal volume, which hatched only two Cowbirds. It is probable that the limit of egg volume that an Oven-bird is able to hatch is between 1.3 and 1.8 times the volume of the normal 5-egg clutch, and doubtless is much nearer 1.3 than 1.8. Probably also the eggs must lie in a single layer in the bottom of the nest.

On June 18, the nest had been torn out by a predator, and undoubtedly the two Cowbirds were destroyed.—Harry W. Hann, *Department of Zoology, University of Michigan, Ann Arbor.*

Flight speeds of some south Texas birds.—In the course of field work in south Texas in 1945, I recorded the following flight speeds (taken at Alice and Bentonville, Jim Wells County, and at Bishop, Nueces County). All records were made by automobile.

	MPH	Date 1945	Distance (yards)	Remarks
Bob-white				
Colinus virginianus	28	June 2	200	Into slight wind
Ground Dove				
Columbigallina passerina	26	June 2	100	Into slight wind
	28	June 2		No wind
	32	June 20	100	No wind (Bentonville[1])
Inca Dove				
Scardafella inca	28	June 2		No wind
Texas Nighthawk				
Chordeiles acutipennis	20	June 2		No wind
	35	July 5	100	Against slight wind
Hairy Woodpecker				
Dryobates villosus	20	July 16	200	No wind
Scissor-tailed Flycatcher				
Muscivora forficata	22	June 2		No wind
	25	June 20	250	No wind (Bentonville)
Mockingbird				
Mimus polyglottos	22	June 2	100	Across and into wind
Sennett's Thrasher				
Toxostoma longirostre	23	June 2		No wind
	29	July 16	400	No wind
Shrike				
Lanius ludovicianus	39	Sept. 18	100	No wind
English Sparrow				
Passer domesticus	20	June 2		No wind
Meadowlark				
Sturnella sp.	25	June 2		No wind
Great-tailed Grackle				
Cassidix mexicanus	32	May 23	100	No wind
	27	June 2	300	No wind
	34	June 20	300	No wind (Bishop)
	39	Aug. 21	440	No wind; flock of 40 (Bishop)
Cardinal				
Richmondena cardinalis	26	June 21	50	No wind
Pyrrhuloxia				
Pyrrhuloxia sinuata	20	June 2	300	No wind
	22	June 21		No wind
Varied Bunting				
Passerina versicolor	28	June 18		No wind
Dickcissel				
Spiza americana	25	June 2	100	Into slight wind
Lark Sparrow				
Chondestes grammacus	27	June 2		No wind
	21–28	June 2		No wind

[1] All records were made at Alice, Texas, except as otherwise indicated in this column.

—Clarence A. Sooter, *1336 North 40, Lincoln, Nebraska.*

Brewer's Blackbird breeding in Ontario.—During the summer of 1943, one of us (A. E. Allin) observed a small male blackbird with straw-coloured eyes in an unsettled portion of the city of Port Arthur, Ontario. Since Brewer's Blackbird (*Euphagus cyanocephalus*) was not known to occur in the Province, this bird was thought to be a Rusty Blackbird (*E. carolinus*), which is a regular spring and fall migrant locally although there does not appear to be any recent record of its occurrence during the summer months. Circumstances did

not permit further investigation at the time. The area was kept under observation for the remainder of the summer of 1943 and in 1944, but no unusual blackbirds were observed. It should be noted that the area had also received some study during the summer of 1942, when a Clay-colored Sparrow (*Spizella pallida*) was heard singing there.

On June 13, 1945, a male blackbird similar to the above was noticed in the same area. Subsequently, at least eight birds were seen there, including females with brown eyes, and we realized that we had located a colony of Brewer's Blackbirds. The birds were carrying insect larvae—suggesting that young birds were near by. The following day we collected a male, and that evening a typical nest of the species was found (by L. S. Dear). It contained four young, about a week old. On our return the next morning the nest was empty; presumably it had been visited by a predator during the night. The nest was collected and forwarded to the Royal Ontario Museum of Zoology with the male obtained the day before. The colony was not further disturbed. The birds were not seen during the summer of 1946.

The region occupied by this colony lies between the two main roads connecting the cities of Port Arthur and Fort William and covers a more or less cleared area, eight acres in extent. A few small, dead American aspens (*Populus tremuloides* Michx.) stood in the portion where the nest was found, and these were used as perching sites. The ground was covered by a six-inch growth of grasses, chiefly redtop (*Agrostis alba* L.). Early flowering sedges (*Carex* spp.) and the sweet white violet (*Viola pallens* (Banks) Brainerd) were generally distributed, as were the early leaves of flowering plants later identified as grass of Parnassus (*Parnassia palustris* L.), asters (*Aster novae-angliae* L. and *A. umbellatus* Mill.) and golden-rods (*Solidago canadensis* L. and *S. uliginosa* Nutt.). To the rear of this area, the ground was heavily covered with Labrador tea (*Ledum groenlandicum* Oeder) and scattered pale laurel (*Kalmia polifolia* Wang.). Above this undergrowth rose a few black spruce (*Picea mariana* (Mill.) BSP) and tamarack (*Larix laricina* (DuRoi) Koch) which were also used by the blackbirds as perching sites.

Brewer's Blackbird has been considered a prairie bird which, like the Clay-colored Sparrow, is spreading eastward, utilizing small open areas in the coniferous forests. It has not yet been seen in Lake or Cook counties in the northeast corner of the neighboring State of Minnesota, but Dr. W. J. Breckenridge, Director, Minnesota Museum of Natural History, has kindly permitted us to include the following evidence of its recent eastward movements in that State as taken from his notes:

"Several Brewer's blackbirds seen along the highway near Virginia, St. Louis County, between June 5th and 11th, 1938." Swedenborg and Prosser.

"Several seen in meadow near Lake Vermillion, St. Louis County, June 9th to 21st, 1938." Swedenborg.

Brewer's Blackbird has not previously been found nesting in Ontario, nor is there a published record of its occurrence in the Province.—A. E. Allin, *Regional Laboratory, Ontario Department of Health, Fort William,* and L. S. Dear, *Box 127, Port Arthur, Ontario.*

EDITORIAL

Preparations are now well advanced for the Wilson Ornithological Club's Annual Meeting at Columbus, Ohio, November 28 and 29. Headquarters will be at the Ohio State Museum. In addition to the regular business and paper sessions, the Local Committee on Arrangements has planned field trips to Buckeye Lake and Hocking County State Park and hopes to have a showing of bird paintings by L. A. Fuertes. Edward S. Thomas, Chairman of the Local Committee, is being assisted by Mrs. Paul A. Barry, Donald J. Borror, Herbert Brandt, Robert M. Geist, Lawrence E. Hicks, Arthur S. Kiefer, John W. Price, Gene Rea, Carl R. Reese, Irvin B. Rickly, Mrs. Edward S. Thomas, Walter A. Tucker, Mrs. Frank Warner, Rowland S. Wilson, and Miss Olga Zurcher.

President Sutton has appointed the following Nominating Committee to prepare a slate of officers to be voted on at the Annual Meeting: Lawrence H. Walkinshaw, Chairman, S. Charles Kendeigh, and Fred T. Hall. Members are asked to send their suggestions to the Committee.

A combined committee of the Wilson Ornithological Club, the Cooper Ornithological Club, and the American Ornithologists' Union has gathered information on the needs of those European ornithologists who, as a result of the war, lack necessary food and clothing. Cheques for "C.A.R.E." food packages (ten dollars) or for Mutual Aid food packages (five dollars or three dollars and a half) should be sent to Mrs. John T. Emlen, 2621 Van Hise Avenue, Madison, Wisconsin. Members who wish to send used clothing may write to Mrs. F. N. Hamerstrom, Jr., Pinckney, Michigan, stating the sizes and types of clothing they have available. Mrs. Hamerstrom will supply from her files the names and addresses of ornithologists to whom such clothing may be sent. To arrive on time winter clothing must be mailed now.

OBITUARY

Wilfred H. Osgood, mammalogist and ornithologist, died in Chicago June 20, 1947, at the age of seventy-one. He was the first president (1893) of the Cooper Ornithological Club, a Fellow of the American Ornithologists' Union since 1905, a member (1897–1909) of the U.S. Bureau of Biological Survey, and a member of Field Museum of Natural History (now Chicago Natural History Museum) since 1909.

Ornithological News

The Society for the Study of Evolution has founded a new quarterly journal, *Evolution*, edited by Ernst Mayr. The first number, which appeared in July, contained an article by Dean Amadon, "Ecology and Evolution of Some Hawaiian Birds."

W. Earl Godfrey, formerly of the Cleveland Museum of Natural History, has been appointed to the staff of the National Museum of Canada in Ottawa.

The *Ornithologische Monatsberichte*, edited by Erwin Stresemann, was before World War II one of the world's leading ornithological journals. We therefore welcome the news that it is resuming publication as *Ornithologische Berichte* under the editorship of Stresemann and Gustav Kramer. The publisher is Carl Winter, Universitatsverlag, Heidelberg, Germany.

ORNITHOLOGICAL LITERATURE

A Field Guide to the Birds. Text and illustrations by Roger Tory Peterson. (3rd ed., revised and enlarged.) Houghton Mifflin Company, Boston, 1947: 4½ × 7¼ in., xxvi + 290 pp., 25 line illustrations, 60 half-tone plates (36 in color), 2 illustrated end papers. $3.50.

In the third edition of a work which was highly successful in both earlier editions (1934 and 1939), and which in the second edition earned for its author the Brewster Medal, one might reasonably expect to find the original work modified only slightly by refinements and additions. Therefore, it comes as a surprise to find that the famous Peterson Field Guide (eastern) has been completely rewritten and re-illustrated.

Although the content has been altered substantially, the basic plan remains unchanged from that pioneered in the earlier editions. Birds are depicted as they are seen in the field, with a minimum of detail except as it may be useful in identifying the species. In figure and text, attention is focussed upon those characters which make it possible to discriminate among similar birds. By condensing into terse phrases his comment on appearance, voice, and range, Peterson has been able to compress a great amount of information into a volume of pocket size. The book is intended for use in the States and Provinces east of the Rockies. People in the western Plains will need to supplement this book with its western counterpart, a Field Guide to Western Birds (1941), or with some other work specializing in western forms.

In the main body of this book, in A.O.U. Check-List order, Peterson treats 440 species plus 7 hybrids and other forms. All but about 20 are illustrated, many by two or more figures; for example, most ducks are shown in three views and some warblers in four. Of those species not figured, the majority are western birds not likely to be encountered except at the border of the area. In the appendix, Peterson discusses 74 species of accidental occurrence and 181 subspecies—a total of 702 forms in the book.

Unlike most other illustrated books about birds, this guide is concerned exclusively with field identification. There is, for example, no discussion of behavior except as peculiarities in actions or habitat may be an aid to recognition. Although such a guide is of greatest value to the beginner, the expert also will find much of interest in it, particularly with regard to accidentals or unfamiliar areas.

Since most readers of this review are familiar with the earlier editions of the Field Guide, they will be interested in noting how this edition differs. The most striking improvement is the more generous use of illustrations, particularly those in color. All of the illustrations are new, and the insert plates have been increased from 40 plates, 4 in color, to 60 plates, 36 in color. Most of the figures are larger than previously, and the total number has been increased from about 600 to 1,000.

The text has been enlarged from 180 to 290 pages, and has been improved materially. In the discussion of each bird, a separate paragraph headed "Similar species" offers suggestions for distinguishing among the birds which bear even a superficial resemblance to one another. The author has followed the practice of his Western Guide in discussing subspecies in an appendix, rather than with the individual species. This is an improvement, it seems to me, for it avoids some confusion in the mind of the beginner and reduces the temptation to glib use of trinomials when subspecific identifications are not possible in the field.

In the main body of this edition, there have been added several species which are found occasionally at the fringes of the area, and in an appendix there are paragraph descriptions of those accidentals which have been seen in the East less

than 20 times. Among the minor innovations are groups of silhouettes of common birds at rest or in flight (a ready-made quiz program for a bird club entertainment) and an eastern check list on which the rarity chaser can record his "life list." An improvement in detail is the listing of the text pages opposite the figures on each plate; thus, the text and the figures now refer to each other.

Peterson deserves praise for his very thorough treatment, in figure and text, of the fall warblers, which have never before been handled so well. The illustrations in the book, in order to show field characters to the best advantage, have a diagrammatic quality; yet some of the color plates are vividly beautiful (for example, the heads of the terns opposite page 134).

This book is the culmination of Peterson's unmatched experience in the preparation of field guides, and I confess that I see no serious faults in it. However, it is probably too much to expect that any critical bird student will ever be satisfied entirely with a set of color plates. Although the draftsmanship is excellent, it seems to me that the printing of the plates is somewhat variable in quality. Many of them are excellent, but others are less well done, particularly those of the fall warblers (grays with a pinkish wash, gray-greens too yellowish) and the sparrows (too reddish-brown). Still, all the illustrations are satisfactory for their purpose.

Peterson shows wisdom in retaining the accepted common names for all species even though in some instances he expresses a preference for another name and offers it as an alternate (for example, British names for the Falcons). In a few instances, alternative names are given opposite figures in the plates without explanation to indicate whether Peterson is advocating a change or accepting a regional usage (for example, Black-necked Grebe, Arctic Loon, Sandwich Tern).

Unfortunately, two plates (Nos. 7 and 9) showing ducks in flight have been transposed. In "My Life List" six names have been placed at the ends of the wrong columns so that they are far out of systematic order (the Robin appearing between the Whip-poor-will and the Nighthawk, for example). I understand that these errors have been corrected in the later books of the first printing.

Although the introduction states that the cover is "waterproofed," a simple test shows that the color comes off with even a slight wetting. It is to be hoped that in some future printing the publisher can offer a genuinely water-resistant cover at little or no increase in cost, since, as tattered copies of the earlier guides testify, a large proportion of beginners carry this book in the field.

The significance of a book like this is tremendous because its greatest influence is felt among the rapidly expanding group of people who are taking their first steps in bird study. We are fortunate that such a superb book is available for the purpose.—Harold Mayfield.

LIFE HISTORIES OF NORTH AMERICAN JAYS, CROWS, AND TITMICE. By Arthur Cleveland Bent. United States National Museum Bulletin 191. 1947: xi + 495 pp., 68 half-tone plates. $1.75.

This, the fifteenth volume of the famous "Bent's Life Histories," deals with some of our best known birds. The work is not a summary, but rather a symposium, with selections of observations, and students generally will come here for data and for ideas. Here we have the field naturalist giving us glimpses of birds' lives chosen from the pertinent literature and from his own experience.

Sometimes we see nearly the same thing through several people's eyes, or hear it through several people's ears: We find Clark's Nutcrackers' nests with Bendire in Oregon in 1876; with Dixon in California in 1934; with Munro in British Columbia in 1912; and again with Skinner in Wyoming in 1916. With Townsend, under his open lean-to, in his "forest" at Ipswich, we listen to mating Crows; again with Forbush on the banks of the Musketaquid we listen to Crows

giving melodious, soft, cooing notes; with Taylor we listen to the tender notes of a Crow in a treetop; and with Allen, we listen to a Crow rhythmically cawing. The material is often in the original observer's own words. This makes for greater bulk and less ease in finding things, but it adds meat to the dry bones, for selections have been made with an eye to the color and charm of their writing. This adds to the readability, and one may get a truer picture, for each writer sees the same thing in his own way.

When we come to the food of Clark's Nutcracker, before the method of getting seeds from pine cones is taken up, the stage is set: "Near me an ancient, gnarled limber pine (*Pinus flexilis*) stood on a wind-exposed knoll, raising a broad, open crown on a brown-plated trunk 2 feet in thickness . . . One of the nutcrackers flew to the tree above me . . ."

Fortunately, no one pattern of interpretation pervades the volume. It is a mine, not only of information, but of the original observers' ideas about the various subjects. Lorenz's idea of *imprinting* is included, as well as many anthropomorphic interpretations of behavior: Crows mobbing an owl because of "antipathy"; the California Jay plaguing a cat for "amusement," in a spirit of "mischief," while a Magpie is doing it "maliciously"; Clark's Nutcracker raising an outcry over game from "curiosity."

The material is classified under such headings as habits, nesting, eggs, incubation, young, plumages, longevity, food, voice, migration, winter, distribution, and egg dates. A section on field identification, included for many of the birds, gives an excellent idea of what the bird looks like in life, and a behavior section describes its "personality." Each subspecies receives a separate heading and treatment, but the better known forms of each species receive most of the attention; there is a protest against "millimeter races" quoted from Taverner under the Long-tailed Chickadee, and some subspecies are dismissed with only characterization and range. The accounts of several species are prepared by special contributors: J. M. Linsdale, B. W. Tucker, E. von S. Dingle, A. O. Gross, and A. Sprunt.

There are many items of special interest because they illustrate how varied are the lives and adaptations of the birds of a given group. The Blue Jay has been recorded as putting ants among the feathers under its wing to store them as food, or carry them to its young (though this may be an example of the little understood behavior called "anting"). The Florida Jay, along with many other corvids, hides away bright objects, such as bottle tops and bits of glass, as well as food.

With material such as this volume provides, comparisons may be drawn and correlations made. Browsing backward and forward, one notes, for example, geographical variation in habit. Crows in the east tend to make solitary nests, high in coniferous trees; in the west Crows tend to be colonial nesters and make their nests lower, and in deciduous trees. The Verdin, in Arizona, uses sticks to reinforce its nest and makes a firm rigid structure, while in Lower California it uses few sticks, and the result is a flexible nest.

The suggestion is put forward that Fish Crows have abandoned a former habit of picking ticks from the backs of cattle and sucking the blood of the animals, and that Florida Jays also have abandoned a habit of picking ticks from cattle. Both these habits were recorded by N. B. Moore, about 1870, in manuscript notes, and have hitherto not appeared in the literature.

The lack of natal down in the Magpie is postulated as an adaptation to a covered nest, but this does not agree with the fact that we find a similar nakedness in some other species, such as the Blue Jay, which have open nests.

Frequently birds appear as "good" or "bad": the Blue Jay is an outlaw and a robber; the Hooded Crow is a rascal; while the good Chickadee is one of the

farmer's friends. But it is pointed out that the food habits of the whole population over the whole year must be considered before a correct estimate of the Crow's economic importance can be gained, and in the case of the Rook an estimate was made of the size and density of the population before conclusions were reached. This last is a good example of work undertaken for its biological interest having real economic value.

Crows, as with many of their relatives, are aggressive birds, well equipped to cope with their environment. They are omnivorous and apparently have great curiosity and activity, continually getting new experiences. One would expect them to be intelligent, and they have long been considered to "have brains." Crows are often kept as pets, learn readily, and sometimes repeat human words such as "hello" and "mama." Psychologists have proved that they are intelligent by having them learn to distinguish geometrical figures. But an unintentional experiment is given in the food section when it might well have been used as an example of intelligence. In almond orchards in Washington, Crows were causing great damage. Thirty thousand Crows were involved, and the destruction of an eight hundred dollar crop was the work of but two days. After various failures at control, poison was inserted in almonds. Not more than one per cent of the Crows were poisoned, but the rest stopped feeding on almonds and left the area. This is intelligence of a high order—for the many to profit by the unfortunate experience of the few.

One is filled with admiration for this compilation—a guide to birds' life histories and to the writings of naturalists. The manuscript was completed in 1941, and only a few things have been added since. Consequently the list of literature lacks a good many items from recent years. A practice that may prove disconcerting to many readers is that of giving the distribution of a whole species under a single subspecies, sometimes not the first subspecies of that bird to be dealt with. The volume closes with 20 pages of "literature cited"; 68 half-tone plates with photographs of birds, their habitats, nests, and young; and an 11-page index.—A. L. Rand.

THE BIRDS OF NORTH AND MIDDLE AMERICA. Part 10. Commenced by Robert Ridgway, continued by Herbert Friedmann. U.S. National Museum Bulletin 50, 1946: 459 pp., 28 figs.

Part 10 of The Birds of North and Middle America, "commenced by the late Robert Ridgway, continued by Herbert Friedmann," is concerned wholly with the Galliformes or "Fowllike birds." Like its predecessor, Part 9, which contained the Gruiformes (cranes, rails, gallinules, coots, sun grebes, and sun bitterns) it is issued under a title page which implies dual authorship, but the volume is actually the work of Friedmann. While one cannot but be impressed by Friedmann's scrupulous sense of fairness to his predecessor as Curator of Birds at the National Museum, it would simplify matters if the linkage of names were discontinued in the concluding volumes. As it stands now, a bibliographer is somewhat at a loss as to just how to cite Parts 9 and 10. Ridgway's contributions are fully set forth in the preface, and full credit is given to him. It would seem that such an acknowledgment more than fulfills every ethical requirement.

In manner of treatment this volume follows closely (as does Part 9) the form used by Ridgway in Parts 1 to 8, save that the figures are incorporated in the text at the appropriate places instead of being inserted at the end of the work. This has its obvious advantages and is to be commended. Further, I approve strongly the adherence to the Ridgway pattern of presentation. This has been criticized mildly by Alden H. Miller (1947. *Condor*, 49:134) as being—though adequate for the standards and limited available knowledge of a half century ago—unsatisfactory for more modern analytical formulae. This criticism

would seem uncalled for in light of Miller's subsequent observation that "surveys like the Ridgway series are by nature comprehensive rather than intensive." In such a case, uniformity would seem to be preferable to any radical change midway. I have in mind particularly the large groups of transoceanic users of this particular series who certainly would not welcome a change from the simplicity of Ridgway to some of the statistical analyses which at times are much more difficult to comprehend than are the characters of the helpless subjects to which they are applied.

A feature worthy of note is the close agreement between the quite independent opinions of Friedmann and the digest of opinions as represented by the findings of the American Ornithologists' Union Committee on Classification and Nomenclature (referring of course to the North American forms treated). Differences of opinion were, particularly in the days of Ridgway's earlier volumes, many and at times violent. These have tended to disappear, in large part because of the infinitely greater amount of data now available. I note but five divergencies in the present volume. These involve one race of the Spruce Grouse and three of the Ruffed Grouse which are recognized by Friedmann but not recognized by the A.O.U. Committee, and one race of the California Quail for which the reverse is the case.

A minor criticism, but one which is valid, is the irritating absence of a closing date for the book. It is obvious that some forms have been given consideration or rather re-consideration at dates later than others, even within the limits of a single genus. An investigator is often uncertain, even with the help of the extensive bibliographies, just where Friedmann's inquiries have ended. A definite date line which could easily be stated in the preface, would be a distinct help. Certain other items have been noted by previous reviewers and need not be reiterated here. They are, however, all of similarly minor character, and indeed one hesitates to mention them at all, considering the general magnitude of the work. —A. J. van Rossem.

BIRDS IN THE GARDEN AND HOW TO ATTRACT THEM. By Margaret McKenny. University of Minnesota Press, Minneapolis, 1947: 7× 9½ in., 8 (unnumbered) + 349 pp., 32 photographic plates, 16 colored plates. $5.00.

Bird-lovers who have tried to purchase "Birds in the Garden" (reviewed in *Wilson Bulletin*, 52, 1940:47–48) will be glad to know that it is now available in a reprint. First published by Reynal and Hitchcock in 1939, it filled a real need by offering authentic natural history material in a style that is interesting to laymen as well as to specialists.

The same press—the Cornwall Press of Cornwall, New York—but a new publisher, the University of Minnesota Press, are responsible for the reprint. The text remains unchanged. There is a slight alteration in the arrangement of the introductory sections, including a welcome list of page references to the diagrams, the color plates (from Roberts' "Birds of Minnesota"), and the photographs. The photographs have been grouped together in one section of the book. The color plates, which are scattered through the book, are in a different order. The colored reproduction of a painting by Walter Weber on the dust cover of the original printing has been replaced by a photograph. Since the portraits of several species of birds were grouped on each of the plates in the original Roberts' book, some birds which certainly never frequent gardens appear in the illustrations—for example, the Kirtland Warbler.

Not only are the trees, plants, and flowers which attract birds listed for easy reference, but means of protecting and helping birds are discussed. Both town and country dweller will find this book an invaluable and attractive reference, whether his interest is in birds or in gardens. Although the book will be of most value to those living in the Minnesota region, anyone in North America will find it useful.—Helen Belfield Bates.

SPRING IN WASHINGTON. By Louis J. Halle, Jr. Illustrated in black and white by Francis Lee Jaques. William Sloane Associates, Inc., New York, 1947: 5½ × 8½ in., viii + 227 pp. $3.75.

Mr. Louis J. Halle, Jr., writes a long essay in the manner of Thoreau, whom he ardently admires, on the exciting natural phenomenon, "Spring in Washington." As is too often the case, the work of the disciple is weaker than that of the master. But when Mr. Halle forgets Thoreau and writes with the excitement which a true birdman feels on discovering an unfamiliar bird or recording something unusual, then he makes his greatest appeal. When he describes his love of the songs of the thrushes, the Veery nesting record, or the swifts going to roost, the reader is rewarded.

Mr. Halle is a keen observer and contributes a few "good" or unusual natural history records. Therefore, it is disconcerting to read his diatribes against man and his works, yet find him resorting to a description of man's handiwork, such as a cathedral, to characterize what he finds most exalting in nature. Or again, to find that he does not perceive that many of the characteristics which he admires in birds he finds distasteful in man.

The black and white illustrations by Francis Lee Jaques are many and add charm to the book. Mr. Jaques' ability to portray beautiful trees, the strength and power of the wings of big birds, especially of waterbirds, and to give in small drawings the feeling of space and breathtaking height will delight his many admirers.—Helen Belfield Bates.

THE FLAME BIRDS. By Robert Porter Allen. Dodd, Mead & Company, New York, 1947: 5¾ × 8⅜ in., xiv + 233 pp., 16 plates (unnumbered). $3.50.

Since "there is no accounting for tastes" is as true as it is trite, I cannot do better than quote the publisher's own description of this book for the benefit of *Wilson Bulletin* readers who have not yet seen it: "The informal story of a bird . . . it tells of adventures with night-prowling crocodiles, of lonely islands weirdly beautiful, of unbelievable human derelicts on lost and forgotten rivers, of the vast solitudes . . ." (from the front of the dust-jacket under two handsome Roseate Spoonbills in flight by F. L. Jaques). The jacket-flap adds: "an informal story that will be enjoyed by *the perfectly normal* person who can't tell a bird from a bumblebee" (italics, mine, I'm afraid).

Mr. Allen writes with considerable poetic enthusiasm, breaking on occasion into rhyme: inadvertent—

"Time is nothing to the mangrove, a decade or two is as fleeting as a half-drawn breath! Time, and the vigor of the mangrove. Life without death." (page 64); as well as advertent—

". . . there're frigate birds and oysters
Little hermits in their cloisters
And proud pelicans who romp [*sic*] beside my door." (page 78).

The ornithological student (with his abnormal faculty for telling a bird from a bumblebee) will no doubt prefer Mr. Allen's previous book on the Roseate Spoonbill (1942. *National Audubon Society, Research Report No. 2*), to which Mr. Allen calls this "a sequel, in a more popular vein" without claiming to present new ornithological material. Indeed, he uses parts of the earlier monograph almost word for word (though without quotation marks); compare page 129 of "The Flame Birds" with page 71, column 2, of "The Roseate Spoonbill." However, all but four of the twenty-one excellent photographs (by Eleanor Pettingill, Allan D. Cruickshank, and others) are apparently new. At least, only four of them are taken from Allen's earlier monograph. One of the new photos shows the downy Roseate Spoonbill (by Hugo H. Schroder), and a fine series of three (by Eleanor Pettingill) shows a pair courting, calling, and nest-building. The book has no index.—J. Van Tyne.

THE COUNTRY DIARY OF A CHESHIRE MAN. By A. W. Boyd. Collins, London, 1946: 5⅜ × 8½ in., 320 pp., 15 plates. 12*s*. 6*d*.

The charm of the English countryside, with its social and architectural stability, its (to us) old-fashioned agriculture, and its surprising (to us) wealth of wildlife, is known on this side of the Atlantic to a favored few travellers and to the naturalists. Mr. Boyd's book (with occasional exotic bird observations from Morocco, Spain, southern France, and Finland) is mainly confined to the animal cycle of bird and insect life in the Cheshire countryside, in the west of England, and finds a worthy place in the competent vein of English natural history that stems quite directly from Gilbert White.

As I was marking passages in *The Country Diary* for discussion in this review, a note on a green viviparous cockroach from the West Indies caught my eye because I once presented just such a specimen, also from bananas, to my own museum, and was twitted by my colleagues on the Museum's acknowledgment in its annual report of the gift of "one cockroach." There is mention of the remarkable phenomenon of the increasing proportion of melanistic butterflies and moths in English urban districts, which has given rise to biological investigations of first rate importance. There are factual notes on predation on song birds by various owls and hawks. Constant mention is made of the recapture of banded birds. There are, in fact, too many items well worth mentioning to be catalogued further.

Much of the charm of the book lies in the range and variety and linguistic flavor of the bird names, many of which are familiar to anyone who reads English literature, ornithologist or no. The common names of birds are for the most part authentic in the vocabulary of the country folk and are not mere artificial book names, like those applied to many American birds. I fear that this is in fact more evidence that appreciation of natural history, and specifically of the kind of competent but non-professional natural history exemplified by Mr. Boyd's *Diary*, flourishes in England but lamentably not in the United States. This disparity between the British and the American amateur naturalists and between the audiences available to the professional naturalists on the two sides of the Atlantic should be a challenge to wealthy America, which too often boasts of its greatness without looking to the elements of culture that make for true and sound greatness.—Karl P. Schmidt.

HISTORY AND MANAGEMENT OF MERRIAM'S WILD TURKEY. By J. Stokley Ligon. University of New Mexico Publications in Biology, No. 1, 1946: x + 84 pp., 19 pls., 2 figs. $1.00.

"Although this turkey has been known since earliest historic times, dating from 1540 . . . authentic information relative to it was scant and sketchy for more than three centuries. Even up to very recent times, comparatively little concerning this strain was known generally" (p. ix). Mr. Ligon has had an unusual opportunity to study the Merriam's Turkey, both through his own observations over many years and through the reports of other Federal and State investigators. Information from both sources is here brought together in five chapters on range and subspecific characters, life cycle and behavior, distribution, nesting and rearing of young, and management. The discussion of management takes up about half of the publication, dealing with such topics as land administration, population estimates, food habits and winter feeding, limiting factors, and restoration through transplantings of wild stock. Ligon considers the major limiting factors to be four, predation, habitat deficiencies and human influences, hunting, and fire, all of which are "more or less man-made, or are influenced by man's activities" (p. 68).

There is a lack of quantitative data in some of the life history material (how many nests, broods, etc.) which will make it difficult for later investigators to

integrate their findings with Ligon's. Quantitative figures on the effect of predation are especially needed, since he emphasizes predator control throughout. Although he has developed a strong argument in support of the necessity for coyote control, he has seriously weakened the whole discussion by the statement: "Increase in predatory animal populations invariably results in decrease of game species, turkeys in particular" (p. 70). There are, perhaps, too few published data on which to challenge his specific reference to turkeys, but the generality simply will not stand inspection.

Ligon is at his best when writing on the larger aspects of his subject—range, distribution, and history; the broad outlines of the life cycle; land use in relation to turkey management. His quotations from field notes give an excellent sampling of some of the details of the bird's life history. Altogether, he has given a great deal of information on a bird which is little known and unusually hard to study.—F. N. Hamerstrom, Jr.

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Miss Eleanor G. Cooley, a librarian, is a graduate of the University of Maryland, where she majored in zoology and minored in botany, spending summers studying birds at the Allegany School of Natural History and the Michigan State College School of Biology. A study of the nesting of a pair of Green Herons which Miss Cooley made in Michigan was published in the *Jack-Pine Warbler* in 1942. She received her M.S. degree in plant taxonomy from Cornell and took her library training at the University of Minnesota. She is a member of a number of scientific societies.

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